

# ELECTRICAL REVIEW

*Extra C2*

FRIDAY  
NOVEMBER 1961

WEEKLY  
PRICE 1s 6d



**G.E.C.**

FOR TRANSFORMERS—rely on the experience of G.E.C.

G.E.C. (ENGINEERING) LIMITED  
TRANSFORMER DIVISION  
BIRMINGHAM 6



Low grade crudes are pumped from the Shell Refinery at Stanlow to Petrochemicals Ltd., Urmston. Here the process plant produces ethylene glycol and other chemical products, using electric power and process steam at various pressures.

The most recent boiler plant commissioned is of John Thompson single drum design and has now seen considerable commercial service.

John Thompson have also supplied five waste heat boilers and a large quantity of ancillary equipment on this modern Petrochemical Process Plant.

## THE CHEMICAL INDUSTRY AND JOHN THOMPSON

### OPERATING DATA:

#### Single Drum High Pressure Boilers —

M.C.R. output of each unit:

270,000 lb/hr.

Steam conditions: 1,500 lb/sq. in.  
1,000°F

Fuels: Asphalt, refinery gas and unmarketable refinery residues.

One unit in operation; one under construction.

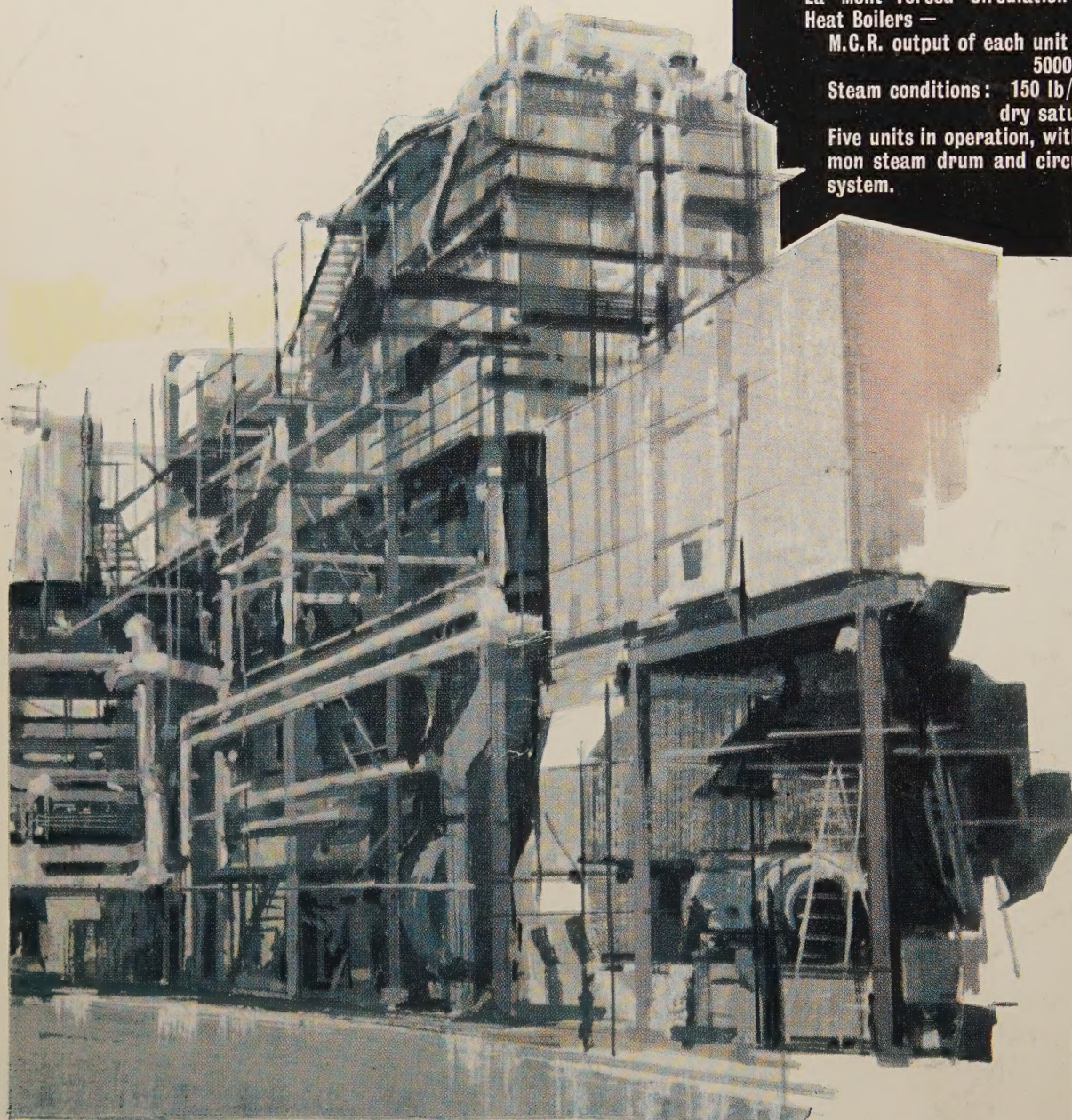
#### La Mont Forced Circulation Waste Heat Boilers —

M.C.R. output of each unit:

5000 lb/hr.

Steam conditions: 150 lb/sq. in.  
dry saturated.

Five units in operation, with common steam drum and circulating system.

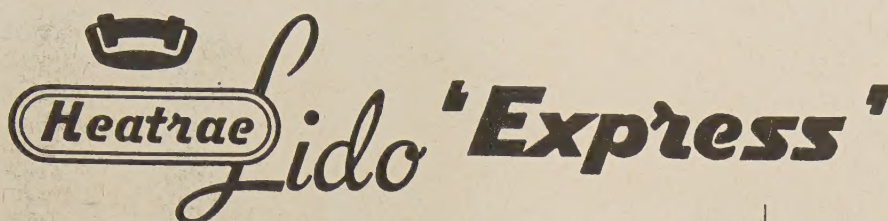


JOHN THOMPSON WATER TUBE BOILERS LIMITED · WOLVERHAMPTON





# AN OUTSTANDING ACHIEVEMENT IN WATER HEATING



## *the most up-to-date* **AUTOMATIC ELECTRIC SINK WATER HEATER**

*Never before has such value, performance, style and craftsmanship been embodied in an automatic sink water heater. The classic styling of the Lido Express will grace any kitchen—and it will maintain its spotless appearance indefinitely.*

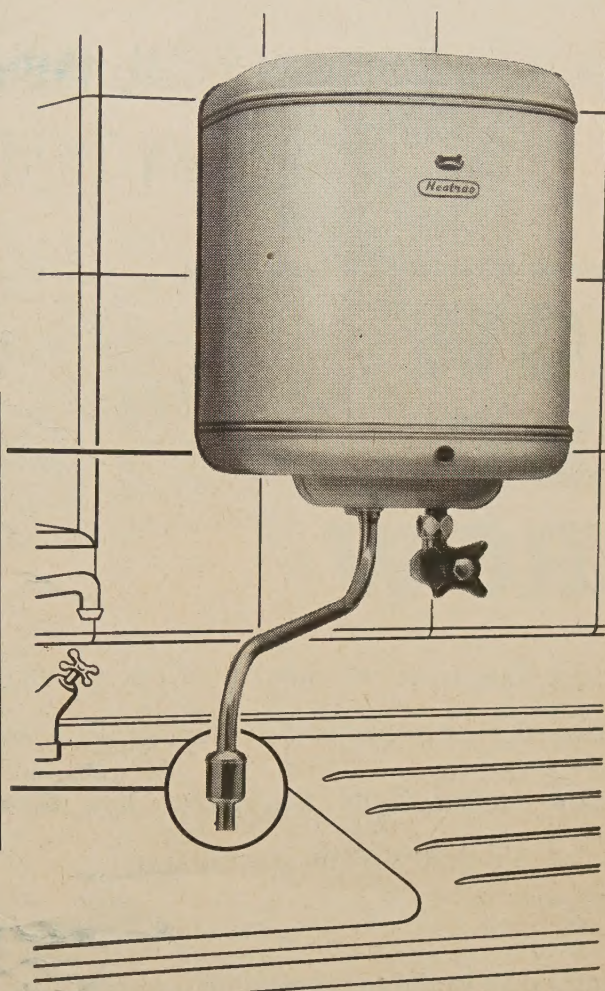
### **2 UNIQUE FEATURES**

● THE ECONOMY EYE gives visual indication of when the current is 'on'—and proof of the low running cost.

● SPECIAL DISPENSER END to outlet spout gives complete flow control and instant cut-off on closing the valve.

A special high-efficiency heating element is incorporated, which provides a continuous supply of piping hot water up to a maximum of 9 GALLONS PER HOUR.\* Diluted with cold, this means approximately 18 gallons at washing-up temperature—adequate for most average households.

\* 6 gallons with 2kW Loading



**Colours: White or Cream**

**Loading: 3kW or 2kW**

**Voltage: 200/220 or 230/250 A.C. only**

Write today for  
**LEAFLET No. 92**

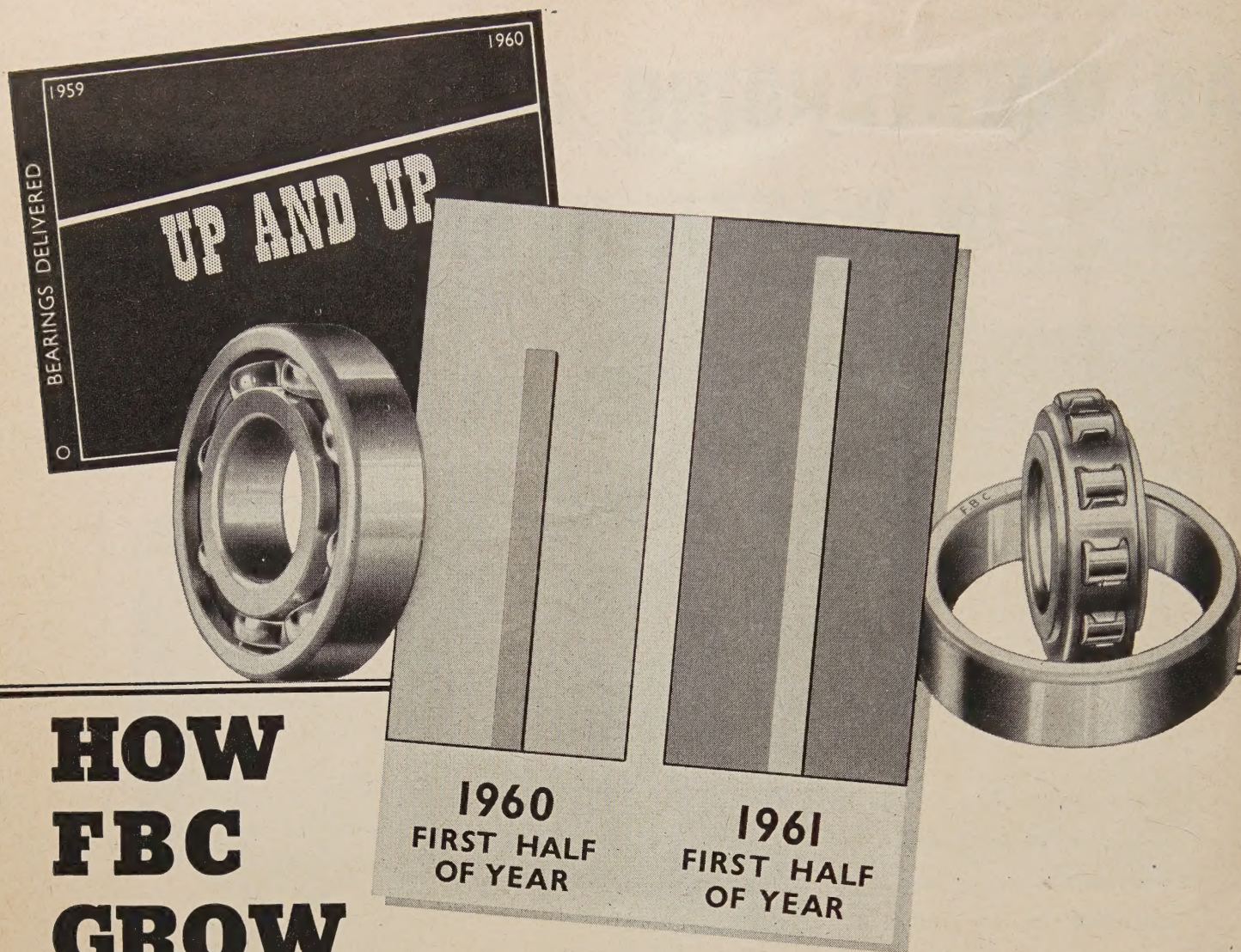
## **HEATRAE LTD**

**NORWICH · NORFOLK · NOR 29A · ENGLAND**

Telephone: NORWICH 23193

Telegrams: Heatrae, Norwich





# HOW FBC GROW

It isn't long since we showed, in one of our advertisements, the great increase in turnover last year.

Here's another figure that proves how our increased service to industry is still bearing fruit:—

In the first half of 1961, sales of bearings were 25% greater than in the corresponding period of 1960!

The wisdom of our new policy is thus confirmed by the demand for our additional range of bearings and transmission equipment.

**FAFNIR BEARING COMPANY LTD., WOLVERHAMPTON**

## A Wide Range of

DEEP-GROOVE  
BALL BEARINGS  
WITH AND WITHOUT  
INTEGRAL SEALS

•  
PARALLEL ROLLER  
BEARINGS

•  
HIGH-PRECISION  
ANGULAR-CONTACT  
MACHINE TOOL BEARINGS

•  
WIDE INNER-RACE  
BEARINGS WITH  
LOCKING COLLAR

•  
POWER TRANSMISSION  
EQUIPMENT

•  
MINIATURE BEARINGS  
FOR INSTRUMENTS ETC.

**A REPUTATION FOR FINE QUALITY**  
**AN INCREASED RANGE OF BEARINGS**  
**GREATLY AUGMENTED FACILITIES**

**F · B · C**  
**FAFNIR**





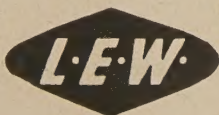
# LEWMEX

the best general  
purpose enamelled wire



Lewmex wire was the first vinyl acetal enamelled wire to be produced in this country. It has a high reputation and is widely accepted in the electrical industry as the best general purpose winding wire, being regarded as first choice for a variety of applications by the leading manufacturers.

Lewmex wire satisfies the requirements of British Standard 1844 and is manufactured in sizes .002" to .160" inclusive.



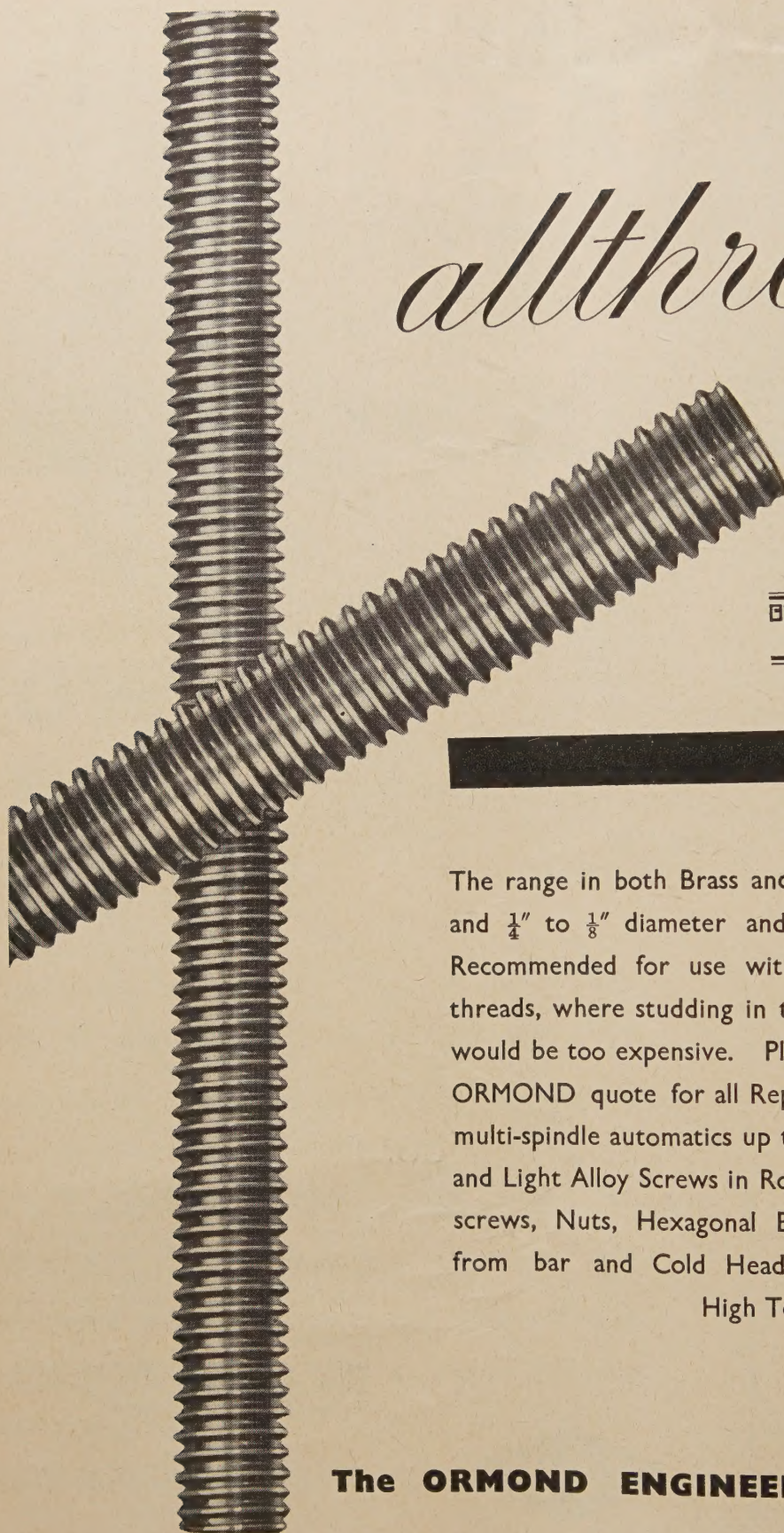
WIRESMITHS TO THE ELECTRICAL WORLD



THE LONDON ELECTRIC WIRE COMPANY AND WIRESMITHS LIMITED

LEYTON · LONDON · E10





# *allthreads*

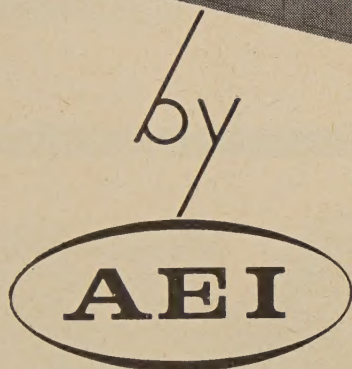
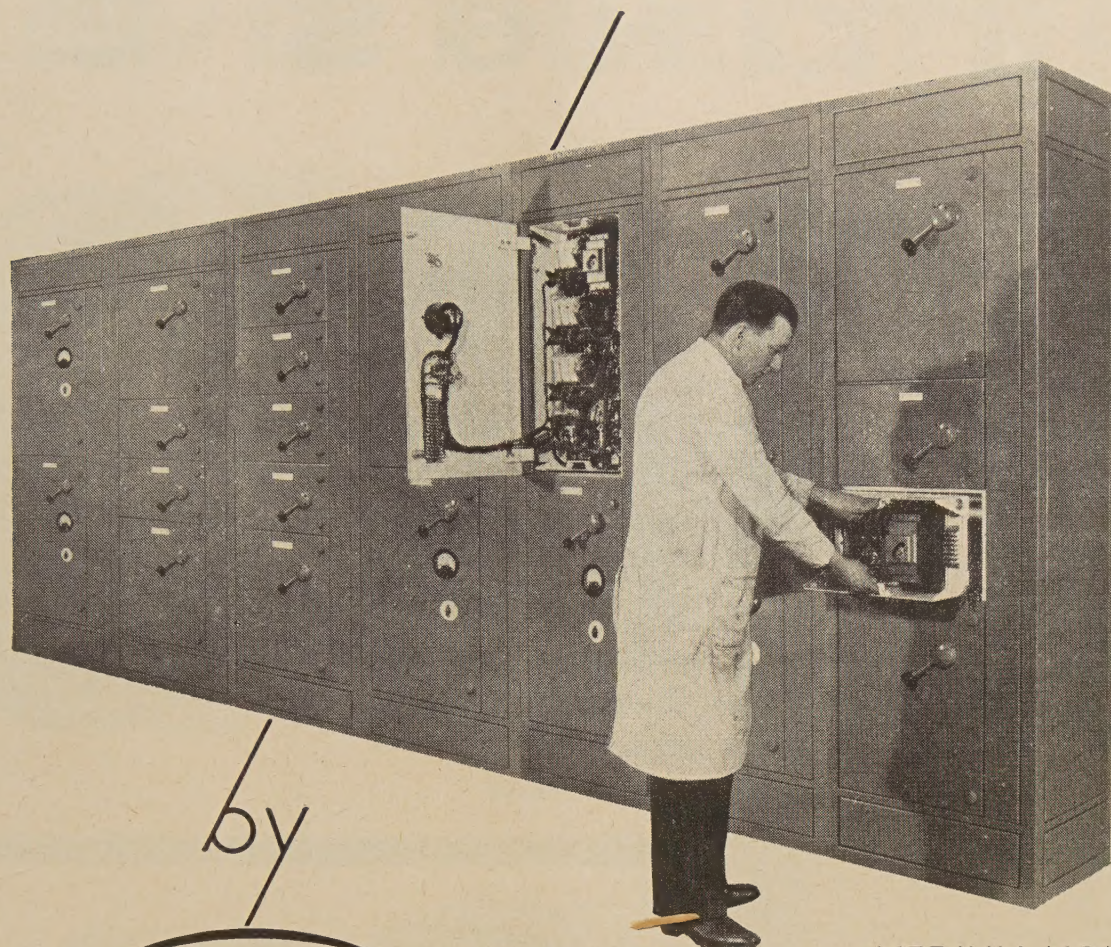


The range in both Brass and Steel is from 0.BA to 5 BA and  $\frac{1}{4}$ " to  $\frac{1}{8}$ " diameter and between  $\frac{3}{4}$ " and 4" long. Recommended for use within this range, with rolled threads, where studding in these lengths in cut threads would be too expensive. Please send for stock lists. Let ORMOND quote for all Repetition Parts—for single and multi-spindle automatics up to  $1\frac{1}{4}$ " diameter; Brass, Steel and Light Alloy Screws in Rolled and Cut Threads, Grub-screws, Nuts, Hexagonal Bolts and Set-screws, turned from bar and Cold Headed Grades "A," "B" and High Tensile.

**The ORMOND ENGINEERING CO. LIMITED**



# MOTOR CONTROL CENTRES



MEDIUM VOLTAGE.  
UP TO 100 h.p.

**SOLVE YOUR GROUPED CONTROL PROBLEMS  
CUT INSTALLATION COSTS  
SAVE SPACE  
SIMPLIFY MAINTENANCE**

Type CCW control centres consist of standardised, free standing cubicles containing withdrawable starter units plugged on to vertical busbars. Units are interchangeable, back-to-back formation when required. Boards are extendible, facilitating forward planning.

*Write for further details*

**ASSOCIATED ELECTRICAL INDUSTRIES LIMITED**

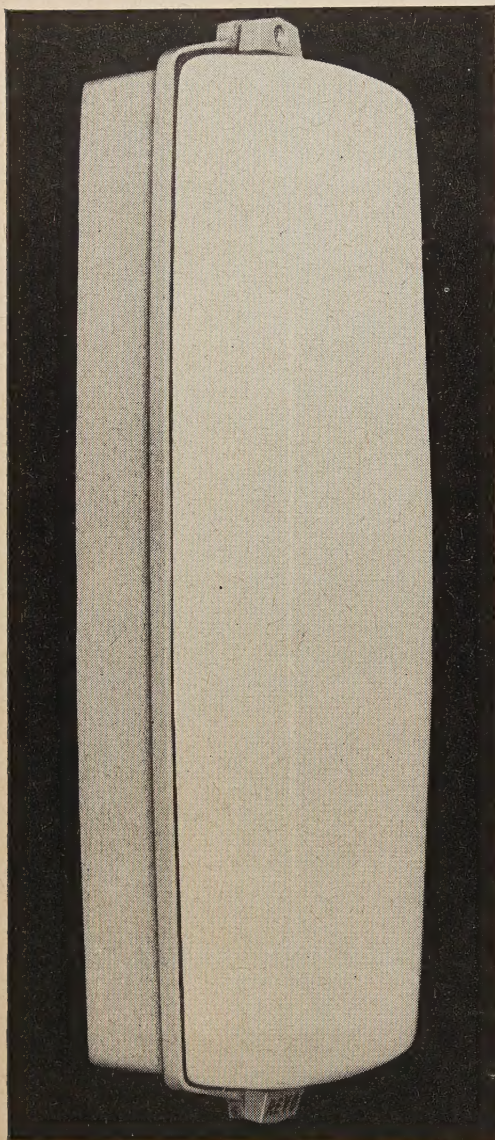
**MOTOR & CONTROL GEAR DIVISION**

**RUGBY & MANCHESTER, ENGLAND**

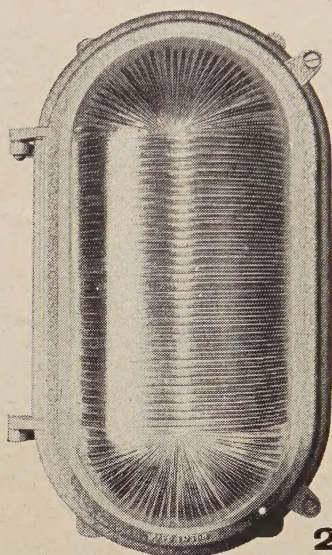
A5543



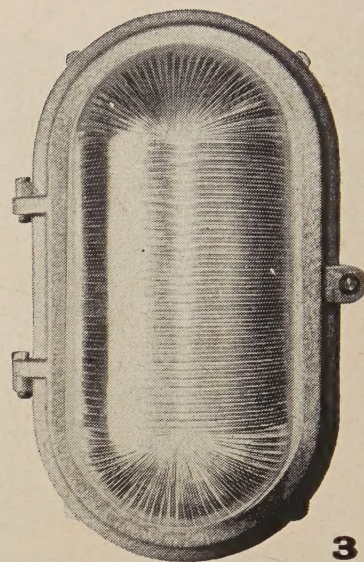
# BULKHEAD & FITTINGS BY



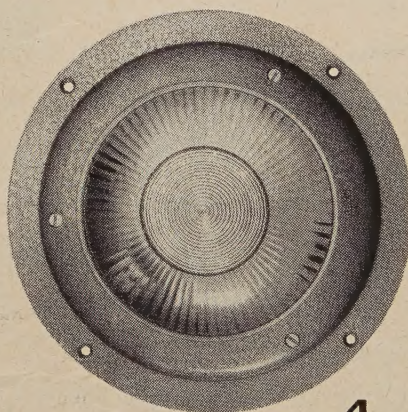
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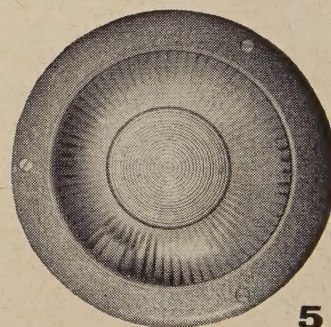
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3



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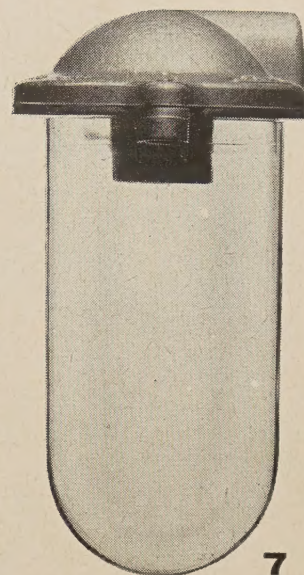
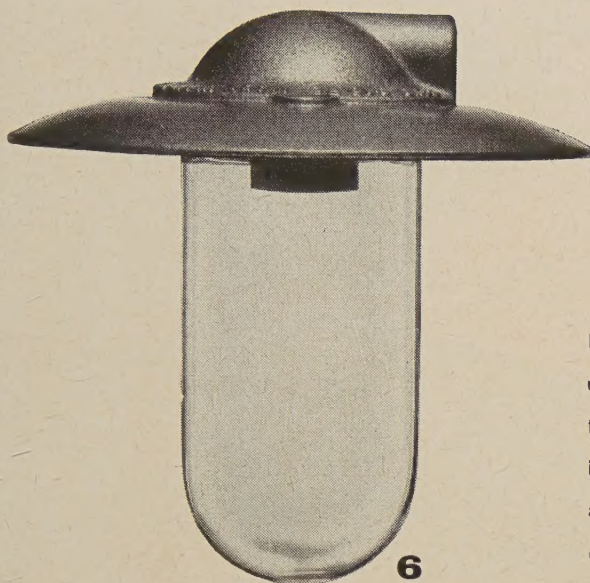
5

The Revo range of high quality Bulkhead fittings is designed to operate in all kinds of adverse weather conditions for long periods and with a minimum of maintenance. Selected from this range are: 1. Fluorescent Bulkhead for 12" tubes (one, two or three) with acrylic plastic cover. 2. Aluminium and 3. Cast Iron Bulkheads (the latter galvanised if required) for 150 watt lamps. Prismatic glass covers. 4. Recessed and 5. Surface mounted "Silver Ring" Bulkheads. Choice of opalescent, or axial or symmetric prismatic glass fronts. All are finished in hammered grey stove enamel. Our illustrated leaflet gives full information.

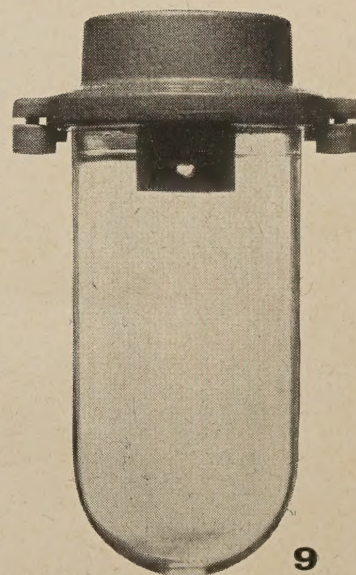
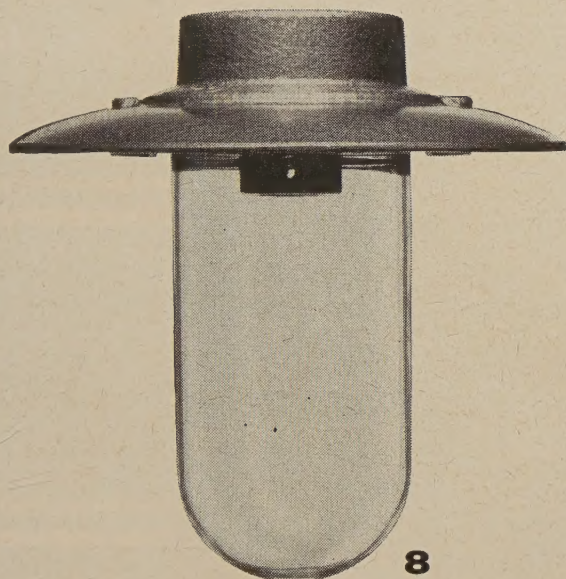
**REVO ELECTRIC CO. LTD., TIPTON, STAFFORDSHIRE**



# WELLGLASS REVO ELECTRIC



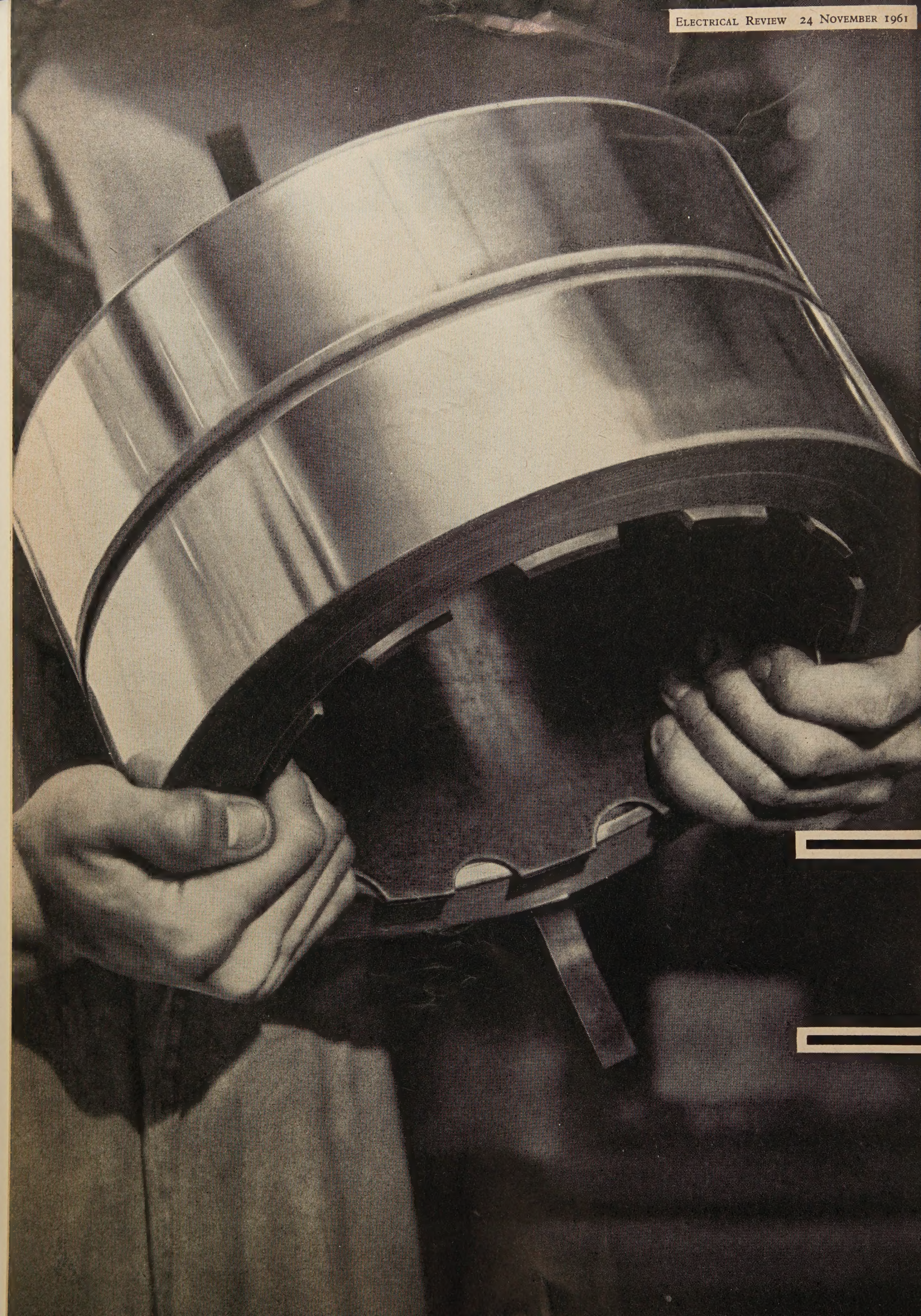
Four standard fittings (Nos. 6, 7, 8 and 9) are illustrated on this page and each is available in either Die-cast aluminium alloy or cast iron, Stove enamel hammered grey finish or galvanised cast iron. Clear wellglass is mounted on a



rubber seating washer and is located by two fixing lugs designed to allow removal of glass without detaching screws. 40, 60 or 100 watt tungsten lamps are suitable for these fittings. Wire guards and matching backplates and brackets are available if required. For full details refer to our leaflet which is obtainable from the address below.

*A Duport Company famous for cookers, fires, fluorescent and industrial light fittings, street lighting, switch and fusegear, etc.*





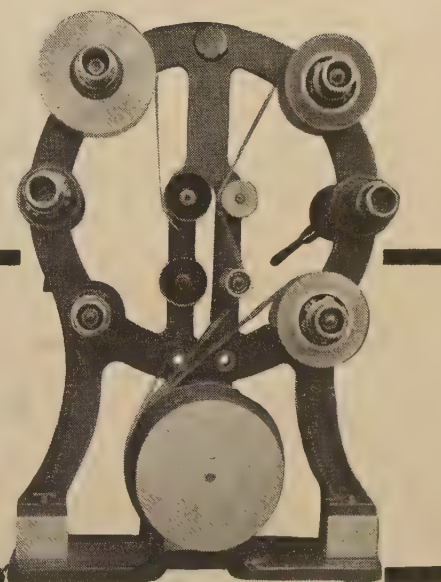


# This transformer coil costs less, weighs only half as much— it's wound with **aluminium strip**

Coils wound with aluminium strip not only have better electrical and thermal characteristics: they are simple to make and show appreciable savings in material costs. Because they have none of the air spaces unavoidable with round wire, they are generally no larger than wire-wound coils of equal power and weigh only half as much. If you would like to know more about strip windings, or other uses of aluminium in the electrical industry, get in touch with any of the Alcan Industries' offices listed below.

## SIMPLE TO MAKE

The winding technique is very simple, needing no costly winding equipment with traversing gear. The coils can be wound on to their cylindrical formers without flanged bobbins. Service and advice are freely available to firms interested in strip winding techniques.



## ALCAN INDUSTRIES LTD

A member of the ALUMINIUM LIMITED OF CANADA group of companies

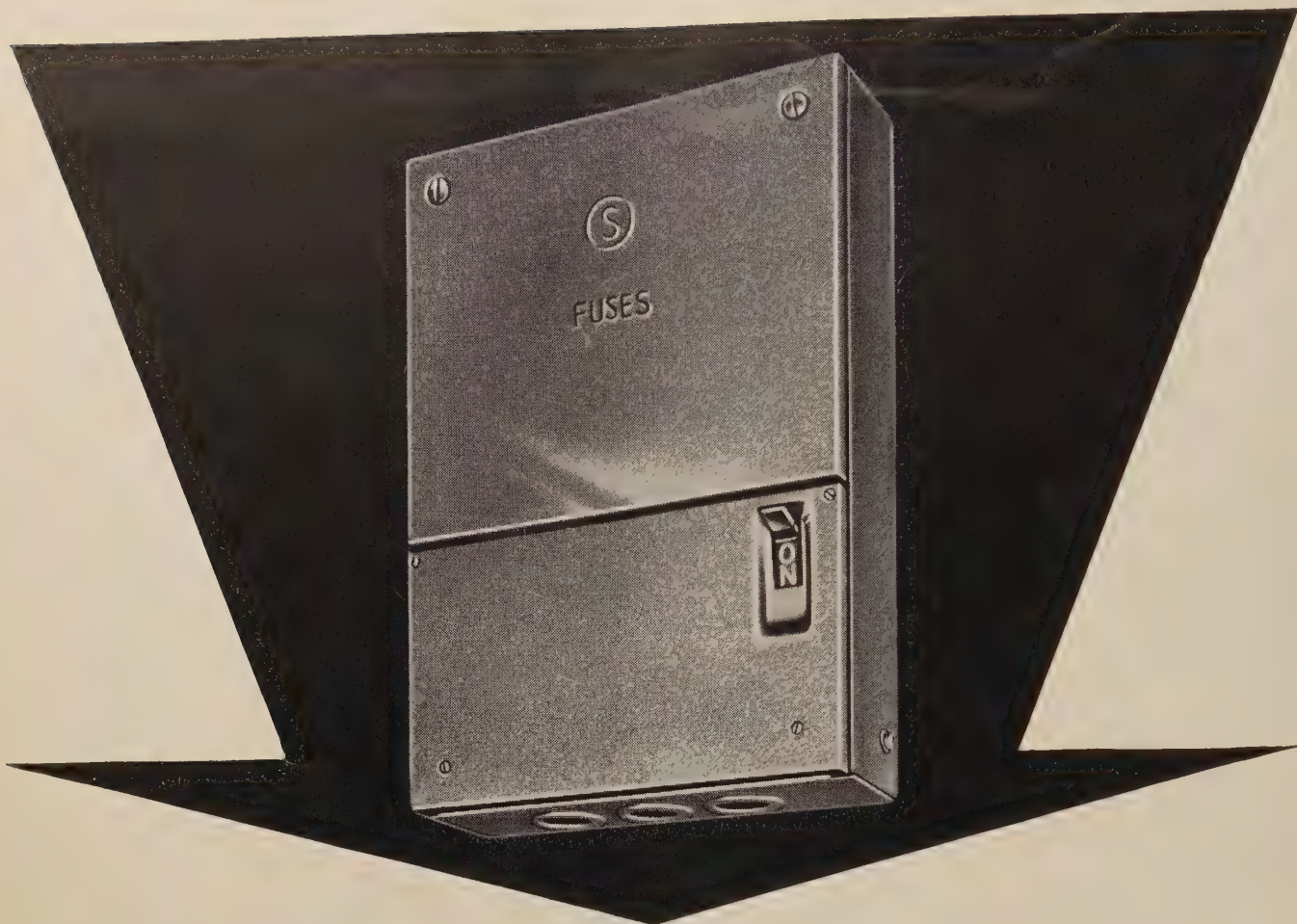
FORMERLY NORTHERN ALUMINIUM CO. LTD

Makers of Noral Alloys

Sales Offices: BELFAST: Donegall House, 7 Howard Street, Belfast 32805 • BIRMINGHAM: Devonshire House, Great Charles Street, 3, Central 7393 • BRISTOL: Pelouin Chambers, 18 St. Augustine's Parade, 1, Bristol 20351 • GLASGOW: 73 Helen Street, Govan, SW1, Govan 3693  
LEEDS: 26-27 Park Row 1, Leeds 33621 • LONDON: 50 Eastbourne Terrace, W2, Paddington 3281  
LUTON: 57 Bute Street, Luton 7364-5 • MANCHESTER: 23 Princess Street, 2, Central 9335  
NEWCASTLE UPON TYNE: Newgate House, Newgate Street, 1, Newcastle 22107 • Castings & Forgings Sales Division: Middlemore Road, Handsworth, Birmingham, Northern 3671.







*and now—*  
 the outstanding new SANDACEE range of A.C. switch fuses

Build your switchpanels into compact space-saving units with SANDACEE A.C. Switch fuses. Smooth projection-free casing permits any form of unit assembly without spacings. Features include fully interlocked front-operated switch having heavy duty solid silver contacts and with ON/OFF indicator.

"Sandaspeed" Duplex fuse units with inter-changeable, re-wireable, or H.R.C. Carriers throughout the range.

Neat modern design, complying where applicable with B.S. 2510 and B.S. 861, affords ample wiring space for fully universal wiring with maximum size cable. Available in S.P. & N., D.P., T.P., T.P. & N. 15, 30, 60, 100 Amp. 440 v. A.C. only.

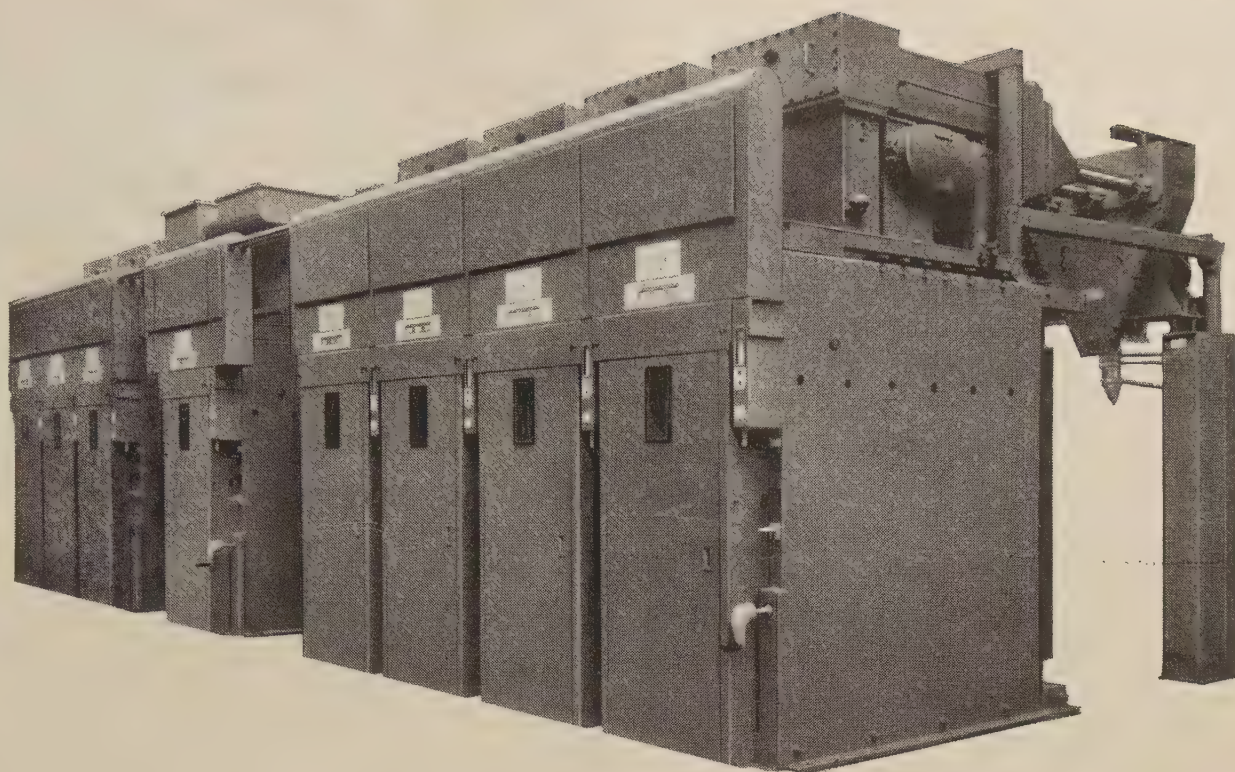
Send for leaflet No. 162/61.



**S A N D E R S**

WILLIAM SANDERS & CO. (WEDNESBURY) LTD.  
 FALCON ELECTRICAL WORKS,  
 WEDNESBURY, STAFFS.





## Types L42T and L45T switchgear

This  
vertically-isolated  
metalclad switchgear  
incorporates many  
novel and desirable  
features and  
fulfils a demand  
for an easily-maneuvrable  
circuit-breaker  
occupying a minimum  
of floor space.

Ask for pamphlet No. 1273

### Ratings:

1000 MVA at 22 kV

1500 MVA at 33 kV

Type L42T: 1200 A  
1600 A

Type L45T: 2000 A

Busbars up to 2000 A

# Reyrolle





## \*"LETS START SOMETHING"!

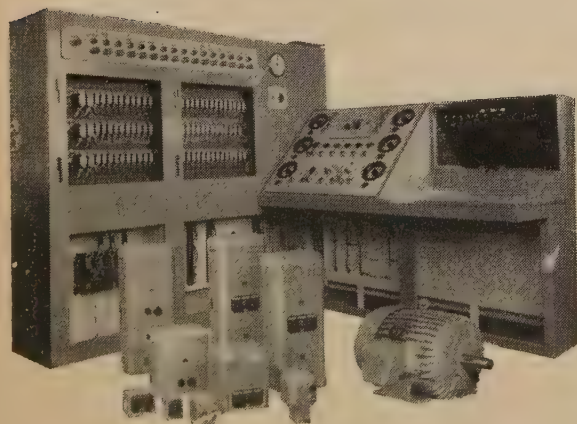
Press a button and start something small . . . a fan . . . a spin dryer. Press another one and you can start a whole factory.

The work is done by one, or perhaps a hundred and one, electric motors. They're so useful! Besides doing the family wash, they save you climbing stairs, lifting or carrying, they help keep your home warm or cool, pump water and help to make things you eat and wear.

Wonderful things electric motors . . . so simple to install and to maintain. If they're BROOK motors then they're as up-to-date as modern methods and continuous research can make them.

Supplemented too by BROOK service. Technical Engineers from sixteen centres in the U.K., BROOK subsidiaries in America and Canada, representatives all over the world . . . just waiting to serve you.

**\*If you really do want to start something, BROOK make starters too! From a simple one to a large panel controlling an entire factory.**



**BROOK MOTORS LTD . HUDDERSFIELD . ENGLAND**



*A few of the important and well-known Companies using Power Track.*

Dorman, Long (Steel) Limited · English Steel Corporation Limited

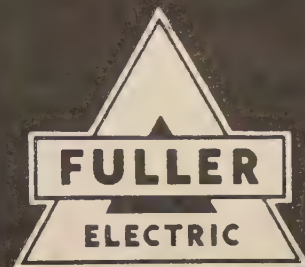
Mersey Docks & Harbour Board · Morris Motors Limited

Rolls-Royce Limited · Selection Trust Limited · Shell International

Petroleum Co. Limited · The Steel Company of Wales Limited

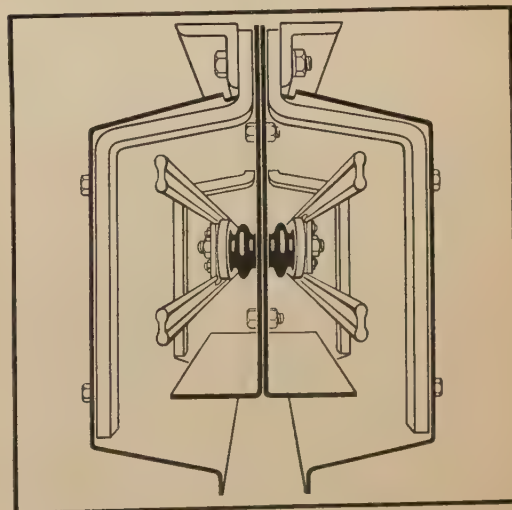
Tube Investments Limited

# CONSULT



# POWER TRACK

No more trolley-wire accidents when you install Fuller Electric Power Track which eliminates the dangers continually threatened by bare trolley wires. More and more factories are being equipped with this simple protected system that ensures safe working conditions. Power Track is guaranteed to give 100 per cent protection when tested with the standard Test Finger to BSS 3042/1958. Unlimited lengths of track, in straight or curved sections, can be erected for operation on all types of supply up to 200 amps per conductor. Isn't it time that your factory was protected by a Fuller Electric Power Track?



**FULLER ELECTRIC LTD. FULBOURNE RD · LONDON E17 · Tel: LARKswood 2350 · SOLE UK REPRESENTATIVES FOR ASEA SWEDEN**

A MEMBER OF

**HAWKER SIDDELEY INDUSTRIES**

P.T 1.



For their new telephone junction boxes,  
the G.P.O. put in a call for Styron 475\*—  
today's high impact polystyrene!  
It has extra strength to resist knocks and abrasions...  
is easy to mould... has excellent  
electrical properties that meet the most  
stringent specifications. Styron is light  
in weight and available in a wide range  
of fade-free colours. It enables  
manufacturers to build maximum performance  
and superb appearance into all types  
of low voltage electrical equipment.  
Put in a call for Styron now  
or write today for  
Booklet No. 235.

\*Styron is a trade mark  
of the Dow Chemical  
Company USA

manufactured by  
Distrene Ltd.

G.P.O. block terminal No. 30  
moulded by Insulators Ltd.,  
London N.18



**G.P.O. dial**  
for  
extra  
toughness!

Sole Selling Agents

**British Resin Products Ltd**

A COMPANY IN THE  
DISTILLERS PLASTICS GROUP

**BRP**

SALES AND TECHNICAL SERVICE DEVONSHIRE HOUSE PICCADILLY LONDON W1 HYDE PARK 8131

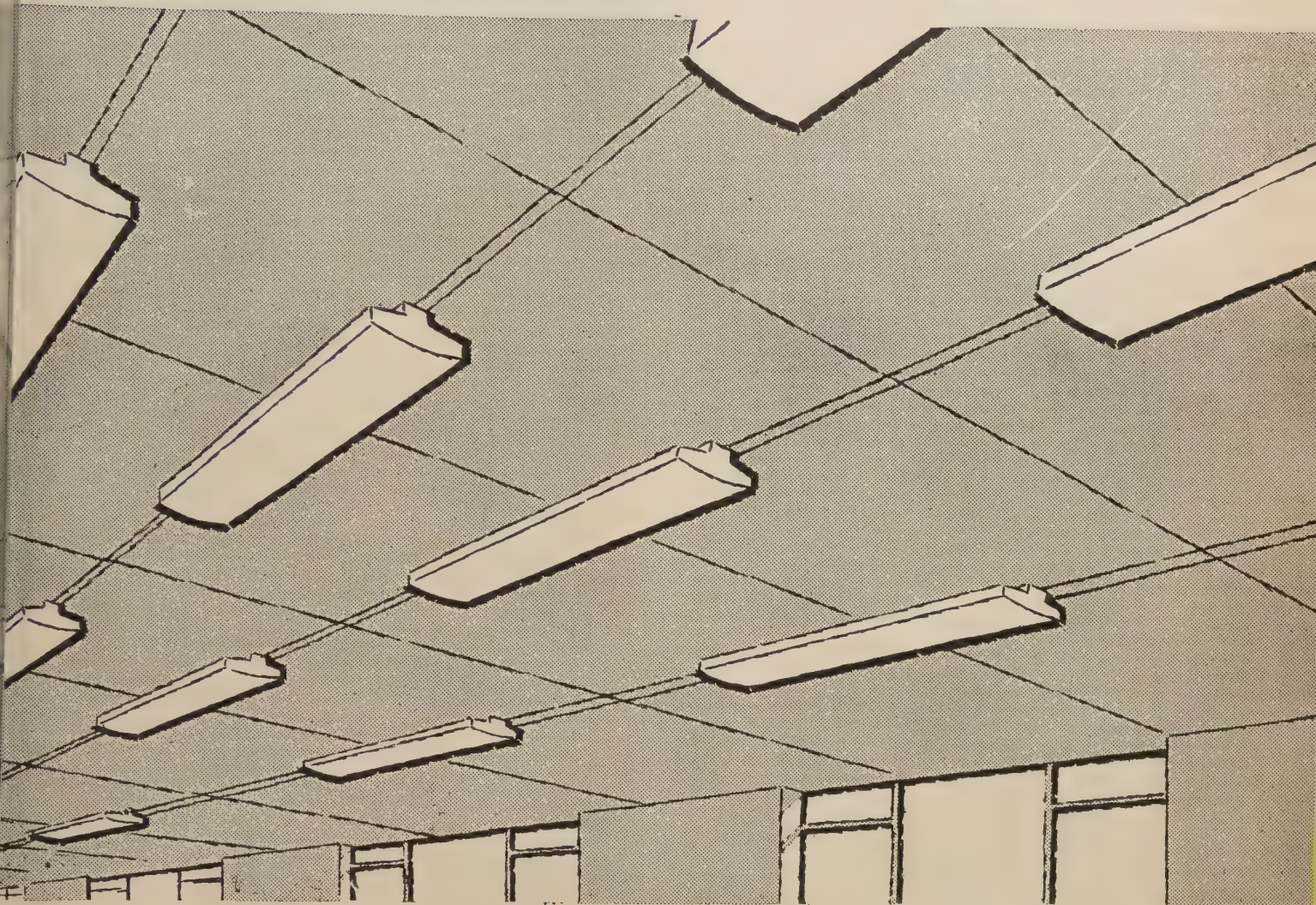
*Distillers Plastics Serve Everyman*



# UNISTRUT

## TRUNKING

### FOR CHEAPER AND NEATER LIGHTING INSTALLATIONS



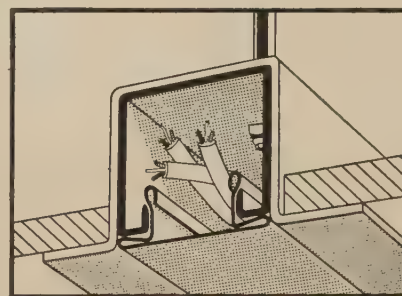
THE UNISTRUT SYSTEM provides the cheapest and simplest method of installing lighting units. UNISTRUT is rapidly and easily assembled, thus reducing on-site costs and time, and it ensures perfect alignment, even when butted to form continuous runs. UNISTRUT trunking accepts most types of fluorescent or tungsten fittings anywhere along its length, and permits the re-arrangement of the lighting at any time.

*Send now for comprehensive literature on UNISTRUT, the answer to your framing and support problems. Write to:—*

**UNISTRUT DIVISION OF SANKEY-SHELDON LIMITED**



43-45 Broadwater Road, Welwyn Garden City, Herts.  
Tel: Welwyn Garden City 26321 (4 lines)

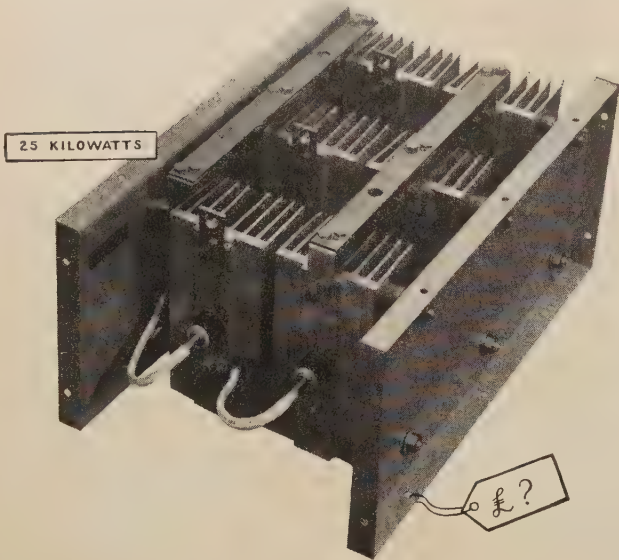


#### UNISTRUT dual-purpose trunking

Where trunking and false ceilings are to be supported, the UNISTRUT 'Top Hat' section is simply placed over the top of the required length of basic UNISTRUT channel. This permits ceiling panels to be closely fitted to each side of the channel, which is itself left open until the wiring installation is completed. Closure is made by standard UNISTRUT closer strip which gives a neat, flush finish.



*Do you  
get your  
kilowatt's - worth?*



RECTIFIER COSTS CAN BE  
SURPRISINGLY LOW!



The power rectifier stack shown has an output of 135 amperes at 188 volts D.C. and costs only £52. 8. 10d. It is just one of a large range of stacks from 20 to 300 amperes; higher currents may be obtained from multiple arrangements.

Individual cells of 10 ampere and 50 ampere rating with p.i.v. up to 400 v. maximum are available ex stock.

May we tell you more? An enquiry will bring full details.

### J. STONE & CO. (DEPTFORD) LTD.

ARKLOW ROAD, LONDON, S.E.14. TID. 1202  
Established 1831

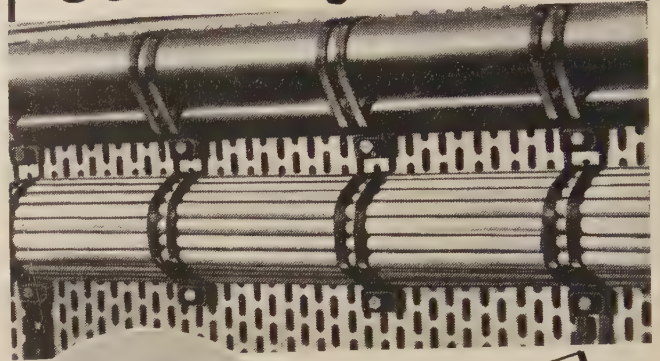
Full information on request from

**SEMICONDUCTOR DIVISION**

GATWICK ROAD, CRAWLEY. TEL. 25251



## complete cable security -



with

**increased  
efficiency**

and

**reduced  
costs**

## Insuloid Type **SAS** saddles

### 2 POINT SINGLE SCREW FIXING

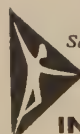
Every type, every size and every combination of cables are secured quickly and more efficiently than ever before with these saddles. Designed for use with standard cable racking, the SAS Saddles are made from tough, virtually unbreakable nylon to withstand the effects of most chemical and acid attacks, and providing for high insulation value, freedom from corrosion and electrolytic action.

- ★ Save time
- ★ Increase efficiency
- ★ Greater versatility
- ★ Made from immensely strong nylon
- ★ Lighter and stronger than metal
- ★ Absolutely anti-corrosive
- ★ Self-tensioning straps
- ★ No need to carry large stocks of components

## .. or Type **AS** saddles

### 2 POINT 2 SCREW FIXING

The quickest, most convenient, most versatile and economical Cable securing method yet available. Designed specially for wall and panel mounted wiring installations, the AS Cable Saddle will accommodate cables of any diameter, type or combination, providing complete security with the highest insulation and anti-corrosive qualities in any climatic conditions. Only 3 sizes are required to cover the most complex cable assembly.



Send for fully descriptive literature covering a full range of Insuloid Cable Clips today.

**INSULOID MANUFACTURING CO. LTD.**  
Sharston Works, Leastone Road, Wythenshawe, Manchester  
Tel.: WYT 2842 & 3163

OS1





## Improved Surface Finish permits:

... and without undue tool wear ... that's what you can expect of the new-style Mallory 73 Beryllium Copper. The treatment now given to all Mallory 73 Beryllium Copper removes the hard abrasive oxide of beryllium—resulting in considerably longer tool life.

The technical advantages of Mallory 73 as a spring material have been long known to the designer. This new treatment brings advantages in production economy also.

*Full technical details are available on request*

# MALLORY

# 73

Beryllium  
Copper

**IMPROVED SURFACE FINISH**

**Johnson  Matthey**

**JOHNSON, MATTHEY & CO., LIMITED**  
controlling MALLORY METALLURGICAL PRODUCTS LTD.

**73-83 Hatton Garden, London, E.C.1 Telephone: Holborn 6989**

**Vittoria Street, Birmingham 1. Telephone: Central 8004**

**75-79 Eyre Street, Sheffield 1. Telephone: 29212**

BC11/689

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*Loughisland-Reevy-County Down*

*By Courtesy of the Northern Ireland Tourist Board*

## *A pleasant outlook*

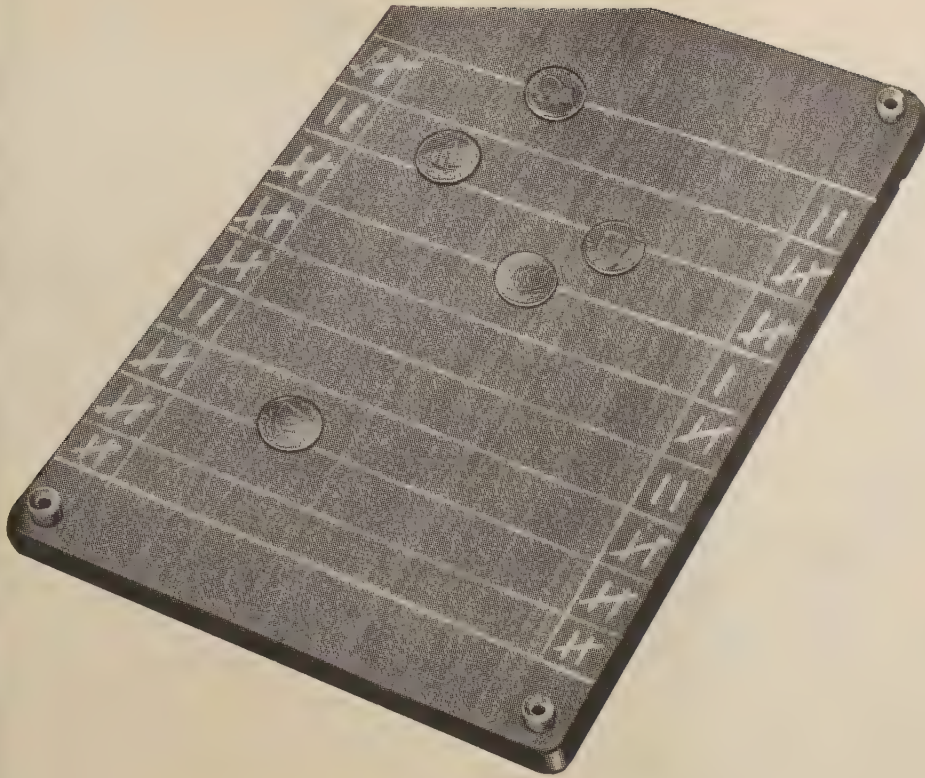
Yes at Irish Cables the outlook for the future is bright indeed. Full production at our Northern Ireland factories and a research team full of new ideas . . . new techniques . . . new materials . . . new types of cable to suit the specific requirements of each industry.

We are leaving no stone unturned to ensure that, with our associated Companies we keep our place as the largest and most efficient independent cable group in Britain.

**IRISH CABLES LTD.**

NEWCASTLE • CO DOWN • NORTHERN IRELAND Telephone: Newcastle (Co Down) 2331/2  
 London Office and Store: 106 Garratt Lane, Wandsworth, S.W.13 Telephone: VANDyke 7544 (7 lines)





### Wootton meter boards win every time!

Obviously, when they're Wootton-made, and Wootton-tested. Made from the best plywood Wootton could lay hands on. Tested for reliability . . . toughness . . . durability. Wootton meter boards stand up to anything. No contraction or expansion warping with Wootton! Oh, and there's more to Wootton than just meter boards. They make wood blocks too, and instrument cases, and they're brilliant at sunk switch boxes.

## WOOTTON—the meter board people

WOOTTON & CO. LTD

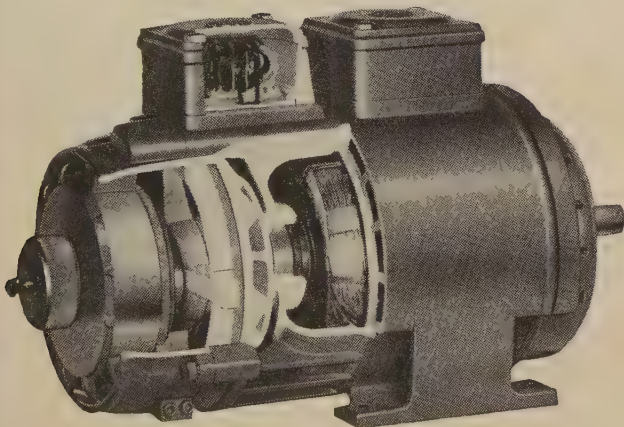
ALMA WORKS · PONDERS END · MIDDX

Telephone: HOwARD 1858

## UNIQUE NEW BRAKE MOTOR from

# LEROY

## F59 with constant life-long braking torque



The new "F59" brake motor from Leroy is strong and versatile.

**Strong**—Throughout the life of the motor a constant braking torque is maintained—due to a completely new patented system which compensates the wearing of the lining. This means that after initial setting there is no need for any readjustment at all.

**Versatile**—The braking torque is adjusted externally by a simple handle device, on the non-drive end of the motor, making it suitable for a wide selection of applications.

Other outstanding points are the compactness of the motor, the low inertia and the fact that it does not have a floating shaft. The "F59" is available from  $\frac{1}{4}$ th h.p. to 12 h.p., is silent in operation and includes a mechanical system to release the brake.

★ It will pay you to know more about the F59. For full details contact—  
**LEROY Electric Motors Ltd.** 58 Theobalds Rd., London, W.C.1. CHAncery 5559  
 and 45 Garden Street, Marrickville, N.S.W., Australia



# RELIABILITY

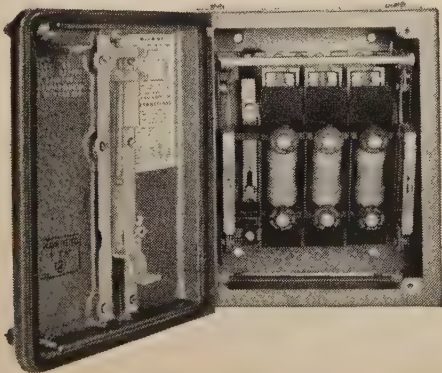
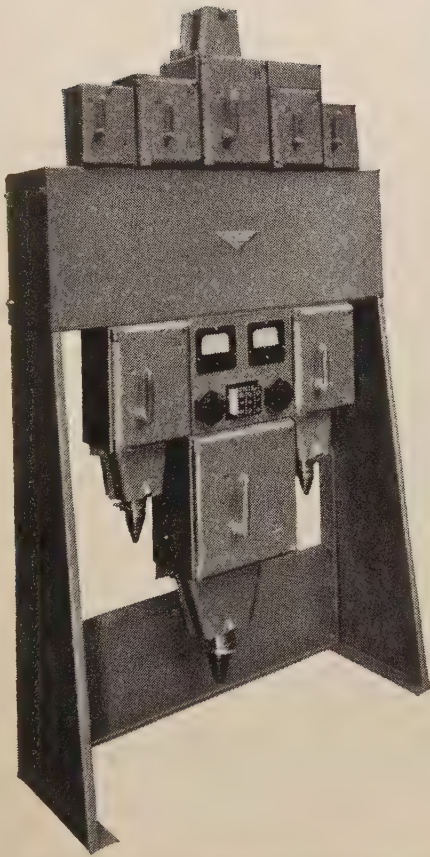
# FLEXIBILITY

# VERSATILITY

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Just three of the many star advantages of the Dorman System of Switchboard Building. Whether you want single units or complete switchboards the answer is the same . . . Specify the Dorman System.

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To: Dorman & Smith Ltd., Preston, Lancs.

*Please send latest Dorman Switchgear and Switchboard Catalogue.*

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POSITION .....

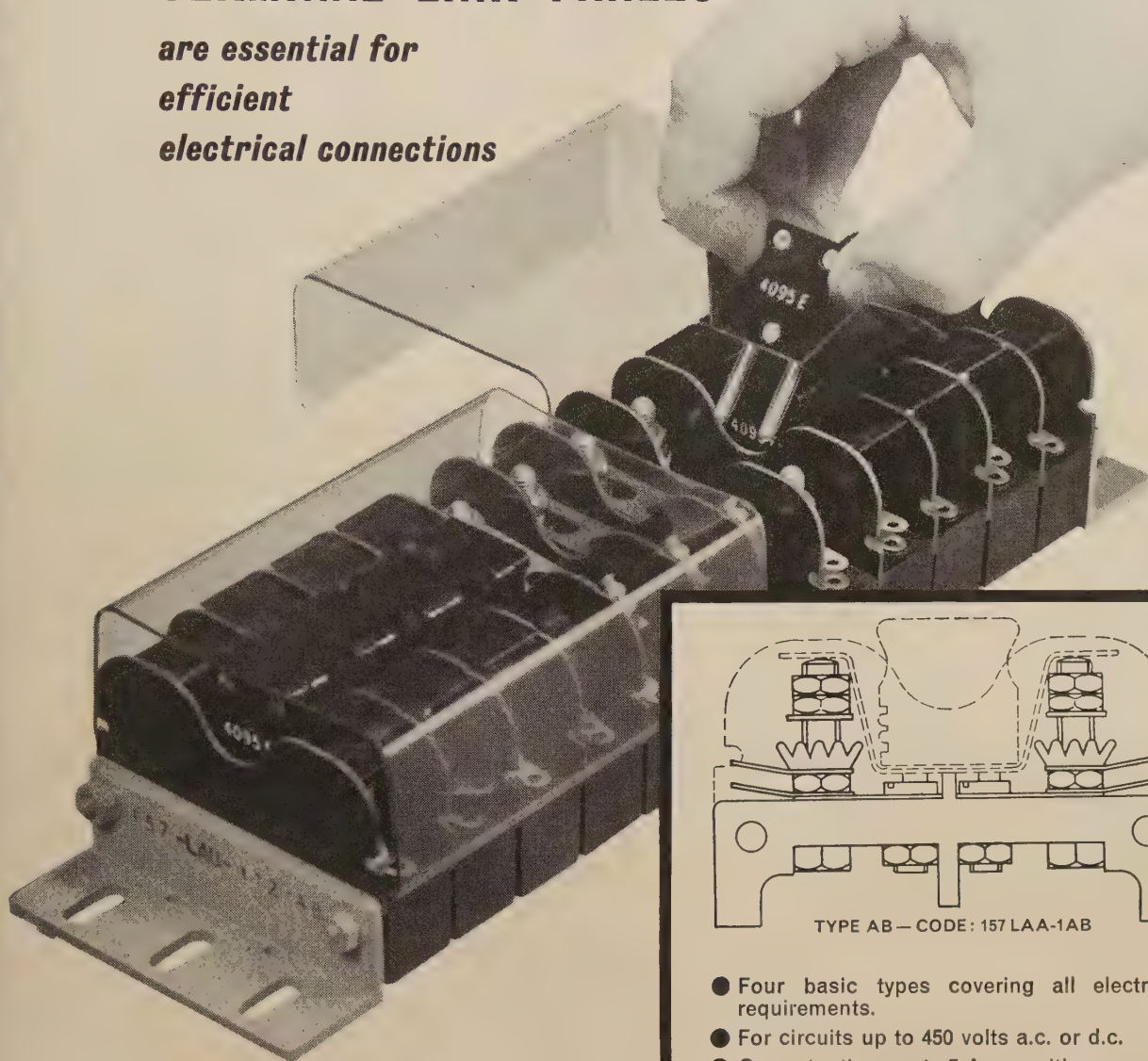
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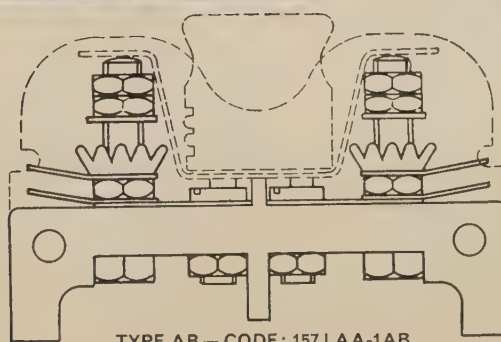


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*are essential for  
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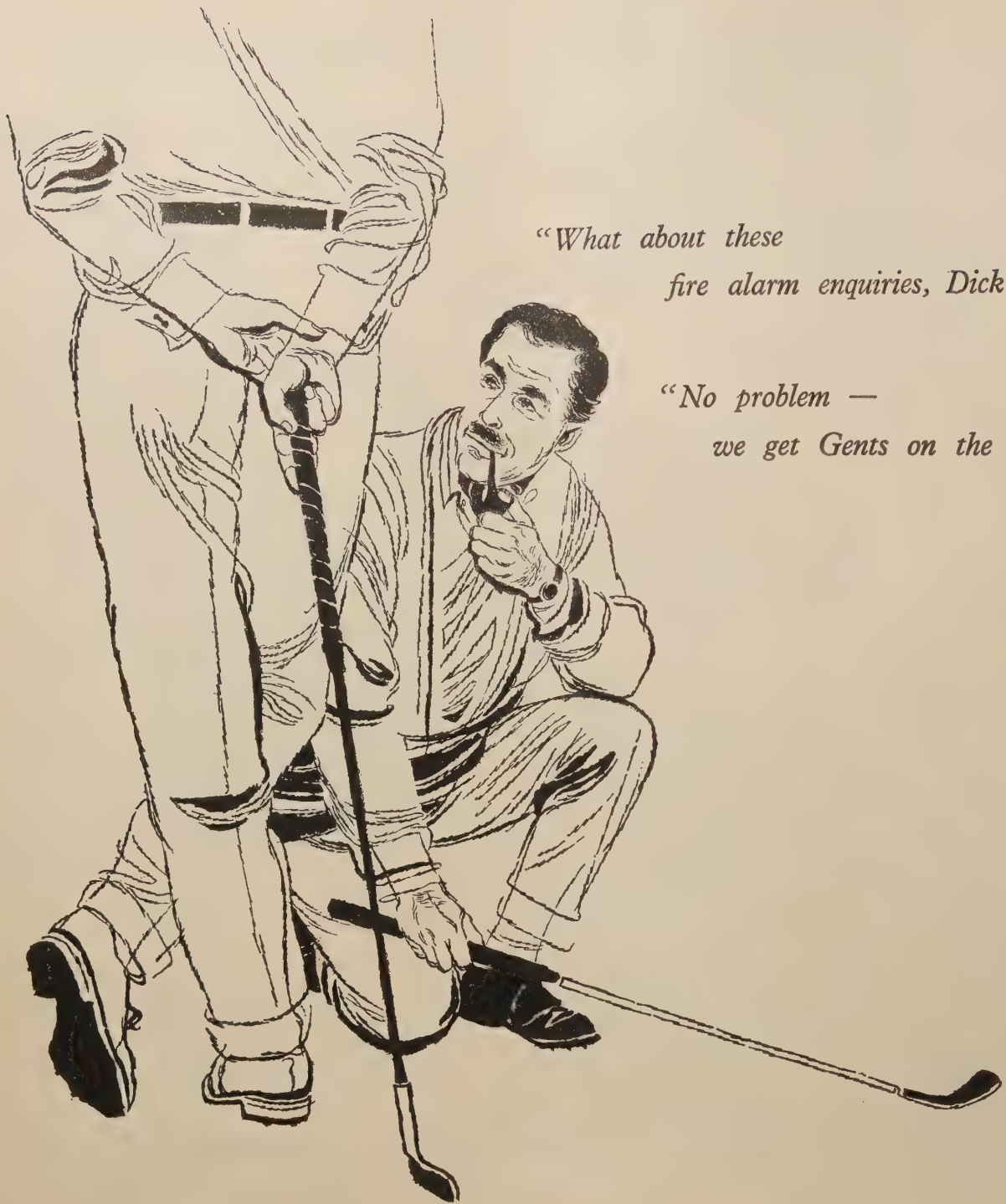


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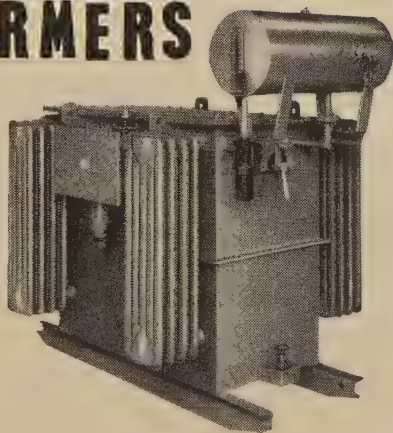
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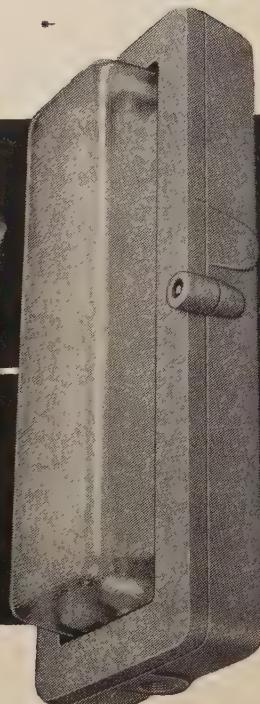
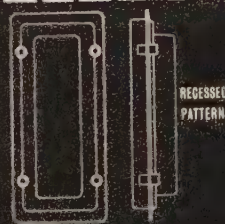
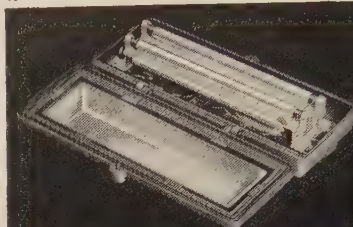
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Light output of one 12" fluorescent lamp is equivalent to a 40 watt coiled incandescent lamp.

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Control gear starter switch type totally enclosed within fitting and wired to 3 way terminal block. Size — over hinges and lock 7", over body 5½".

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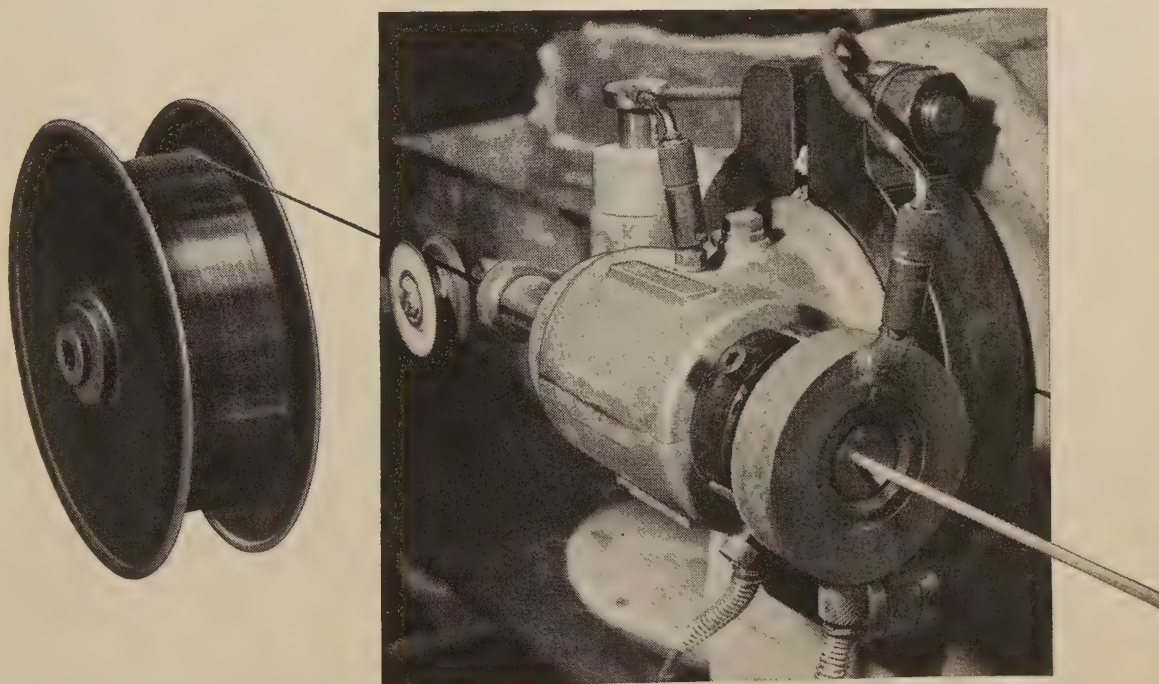
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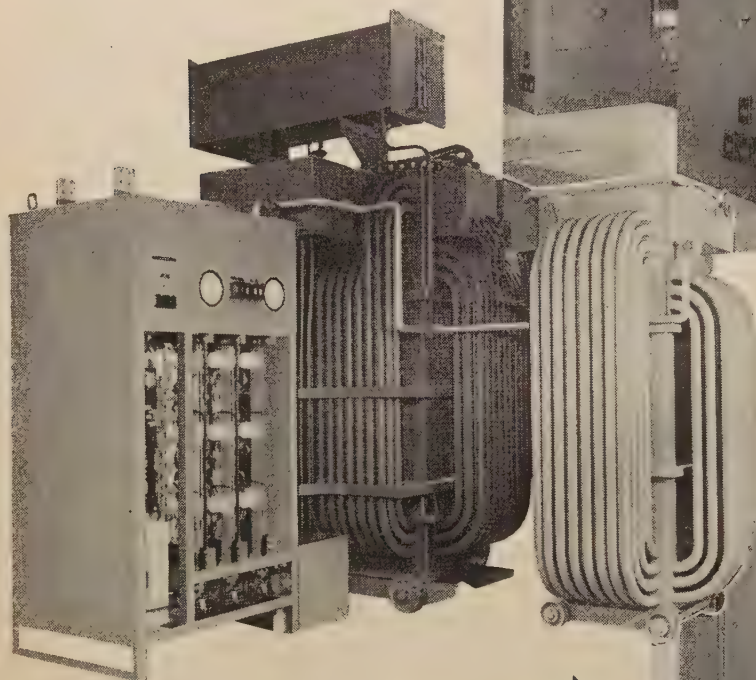
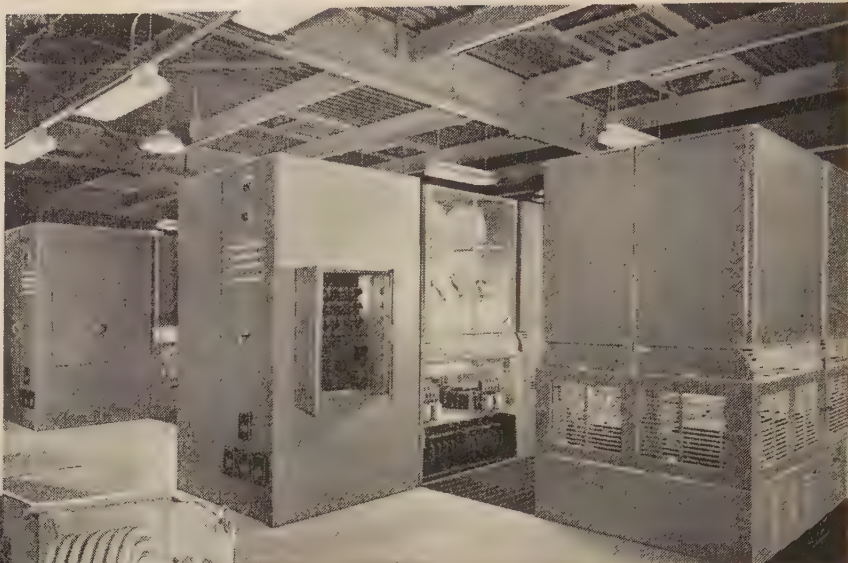
*Distillers Plastics Serve Everyman*



# — RECTIFICATION —

## MERCURY ARC

A Mercury Arc Rectifier installation at the works of Western Chemicals Ltd., Alberta, providing an output of 12,000 amps at 510 volts D.C. for electrochemical duty.

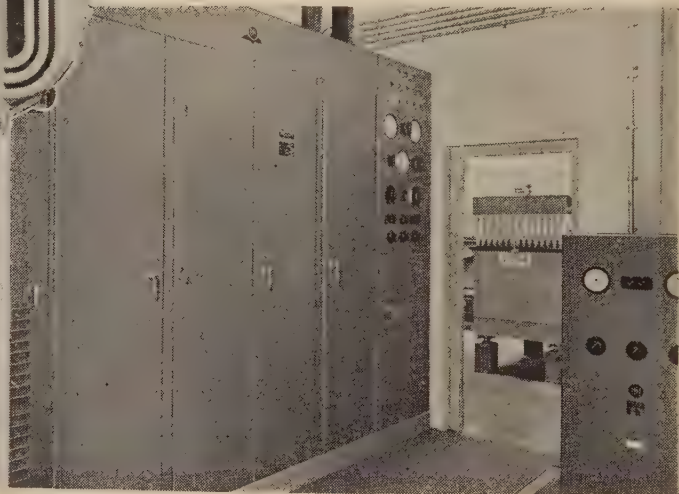


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A 750 kW 3,000 amp forced air-cooled Silicon rectifier for electrolytic duty in Persia. A voltage regulator is included for voltage variation over the range 180/250 volts D.C.

## GERMANIUM

A 6,000 amp water-cooled Germanium rectifier providing a continuous output at 100 volts D.C. for an electrochemical process at the Luton Works of Laporte Industries Ltd.



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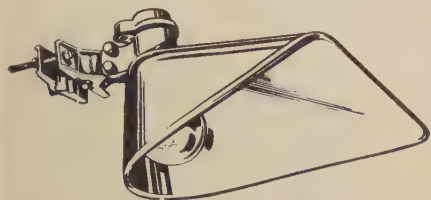
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**List No. 890**

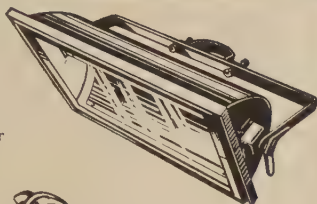
'Realux' Overhead Mounting model, for G.L.S. or M.A./V. lamps.



## YOUR FLOODLIGHTING PROBLEM

**List No. 940**

Downward lighting Sodium Lantern for wall or pole mounting.

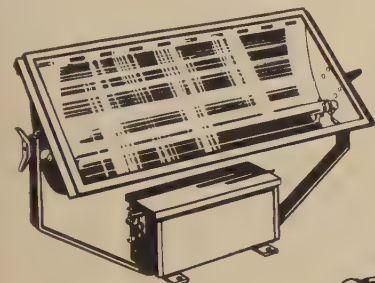


**List No. 775**

'Festival' Lanterns for G.L.S. lamps from 100 watt to 1000 watt size.

**List No. 920**

Telescopic Tripod for Floodlantern mounting.

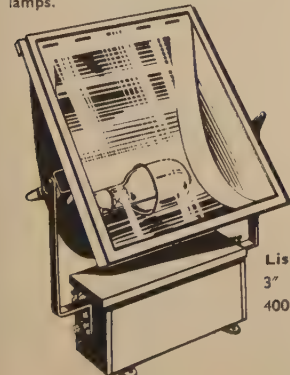


**List No. 942**

Upward lighting Lantern for 200 watt Sodium lamp.

**List No. 556**

Narrow beam Projectors for 500 watt to 1,500 watt G.L.S. lamps.



**List No. 1231**

3" focus Lantern for 400 watt MBF/U lamp.



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Possibly the most comprehensive range of any British manufacturer. Every type of lamp is catered for with either upward or downward lighting Units.

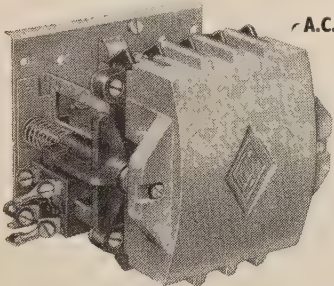
Catalogue P 6004 details the R.E.A.L. range

**ROWLANDS ELECTRICAL ACCESSORIES LIMITED,  
R.E.A.L. WORKS, BIRMINGHAM, 18**



# Save Space!

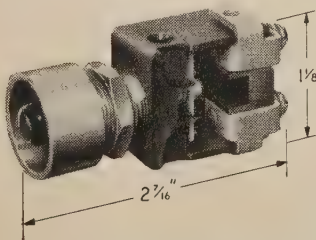
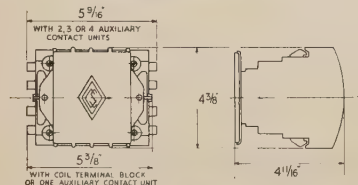
## SPECIFY MINIATURISED ELECTRICAL ACCESSORIES



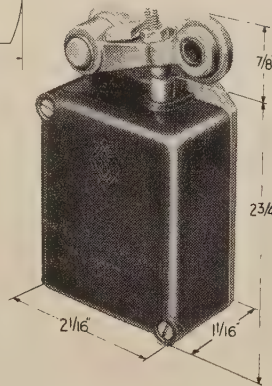
A.C. CONTACTOR REFERENCE 26

12½ h.p. 415 v. 50 cycles. 3 phase.

Tested to prove compliance with BSS775/1956, and is rated at 25 amperes Category A1, Class II and 12½ HP (20 amperes) Category A4, Class II at 380/550 volts. Category A4, Class III and IV ratings available on application.



FLUSH PUSH BUTTON

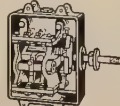
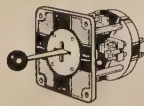
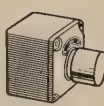
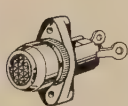
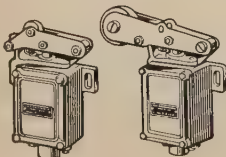


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Change-over contact  
Quick make and break

Rating :  
2 amps 250 v } A.C. Inductive  
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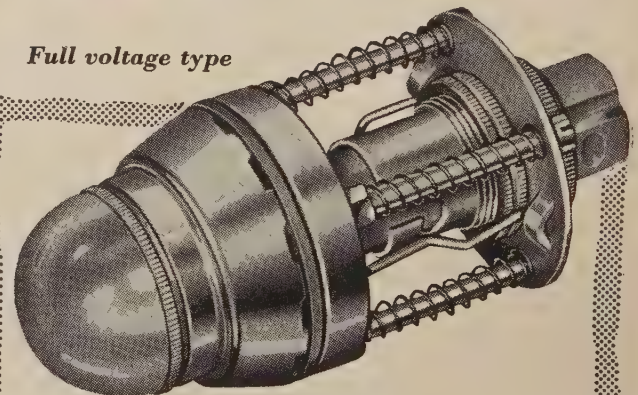
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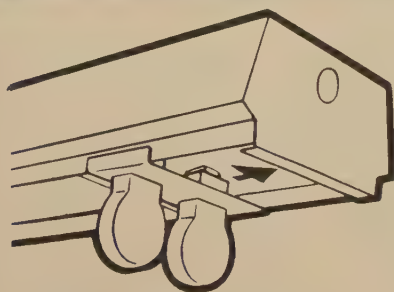
# NEW DURHAM Lighting Fittings

RANGE



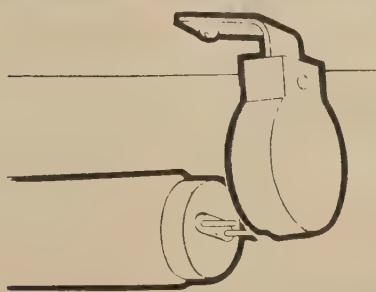
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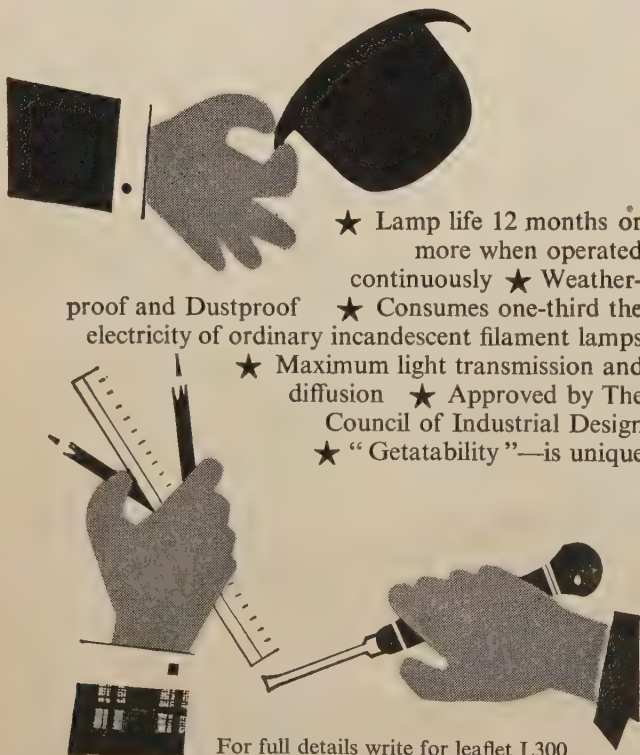
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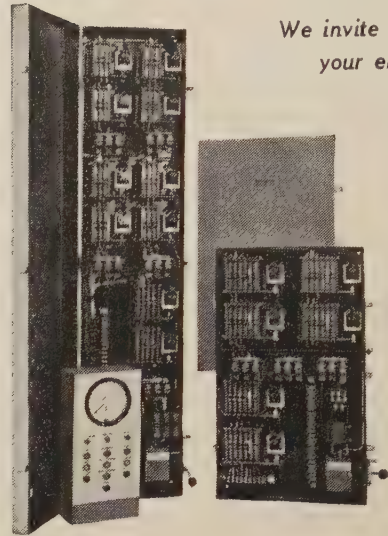
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To customers' requirements

We invite  
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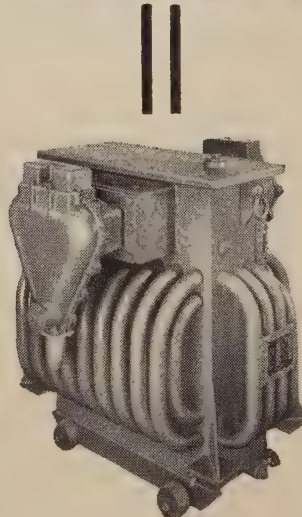
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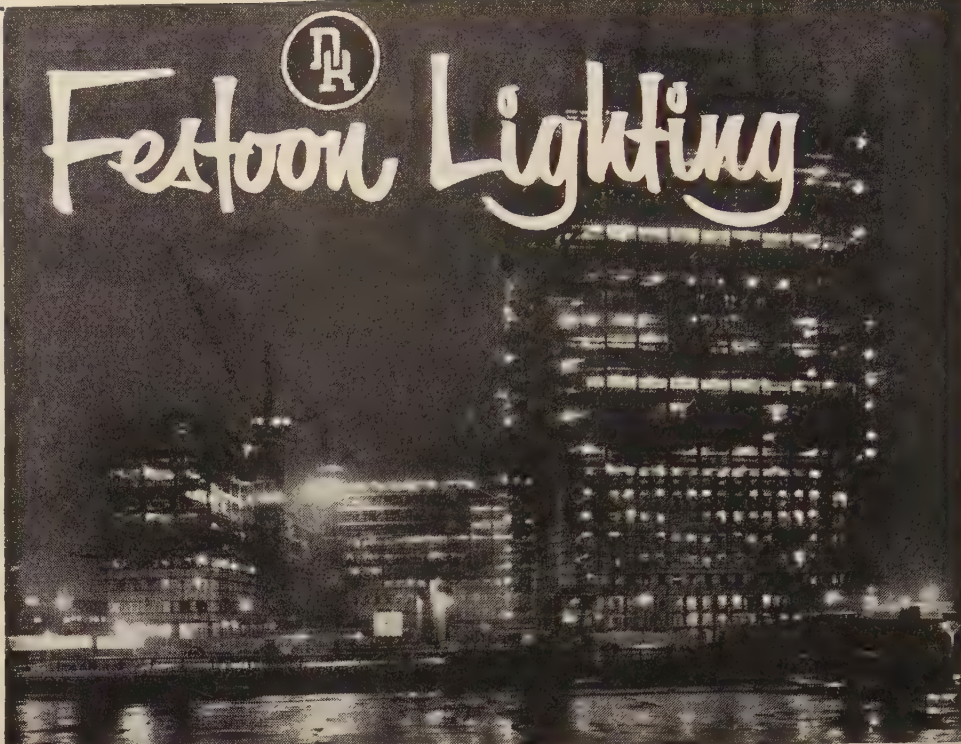
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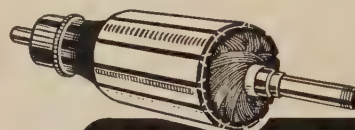
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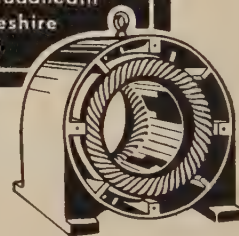
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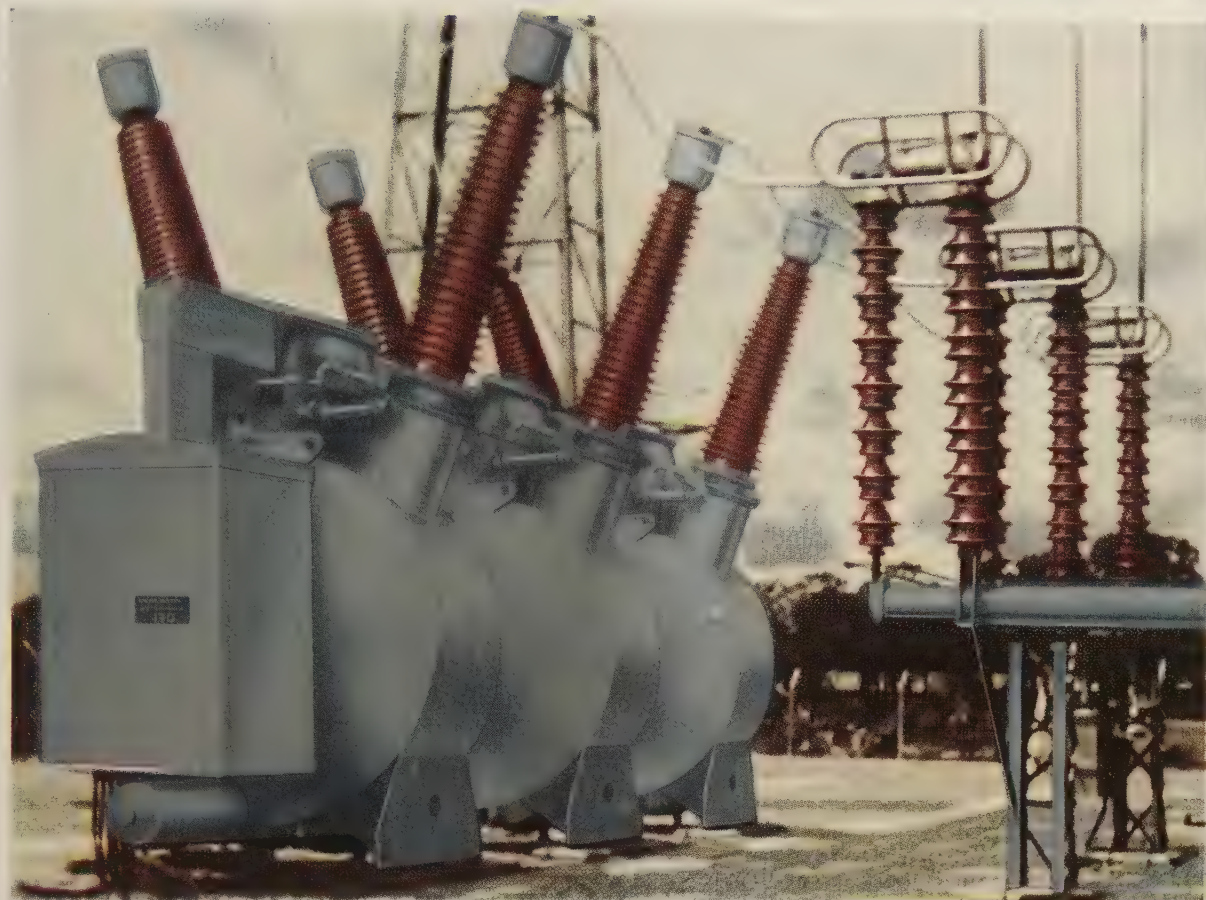
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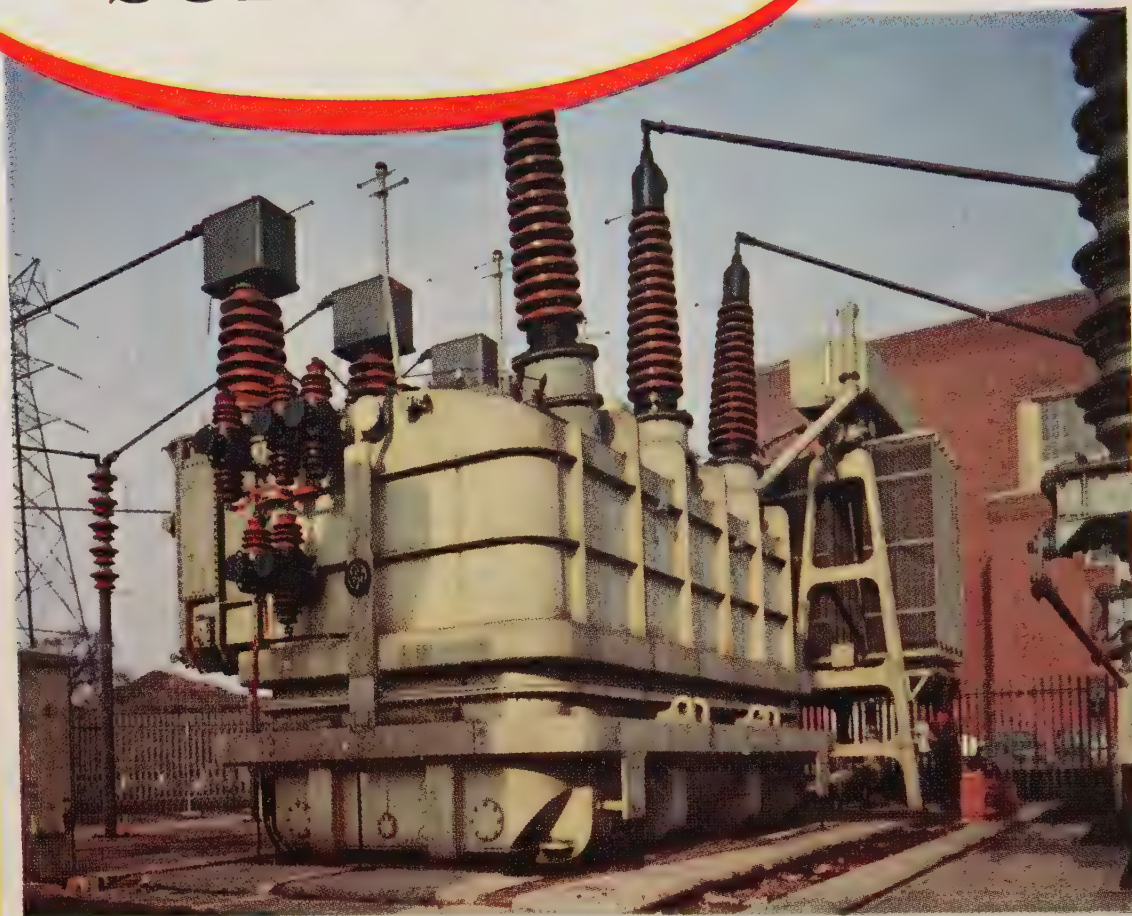
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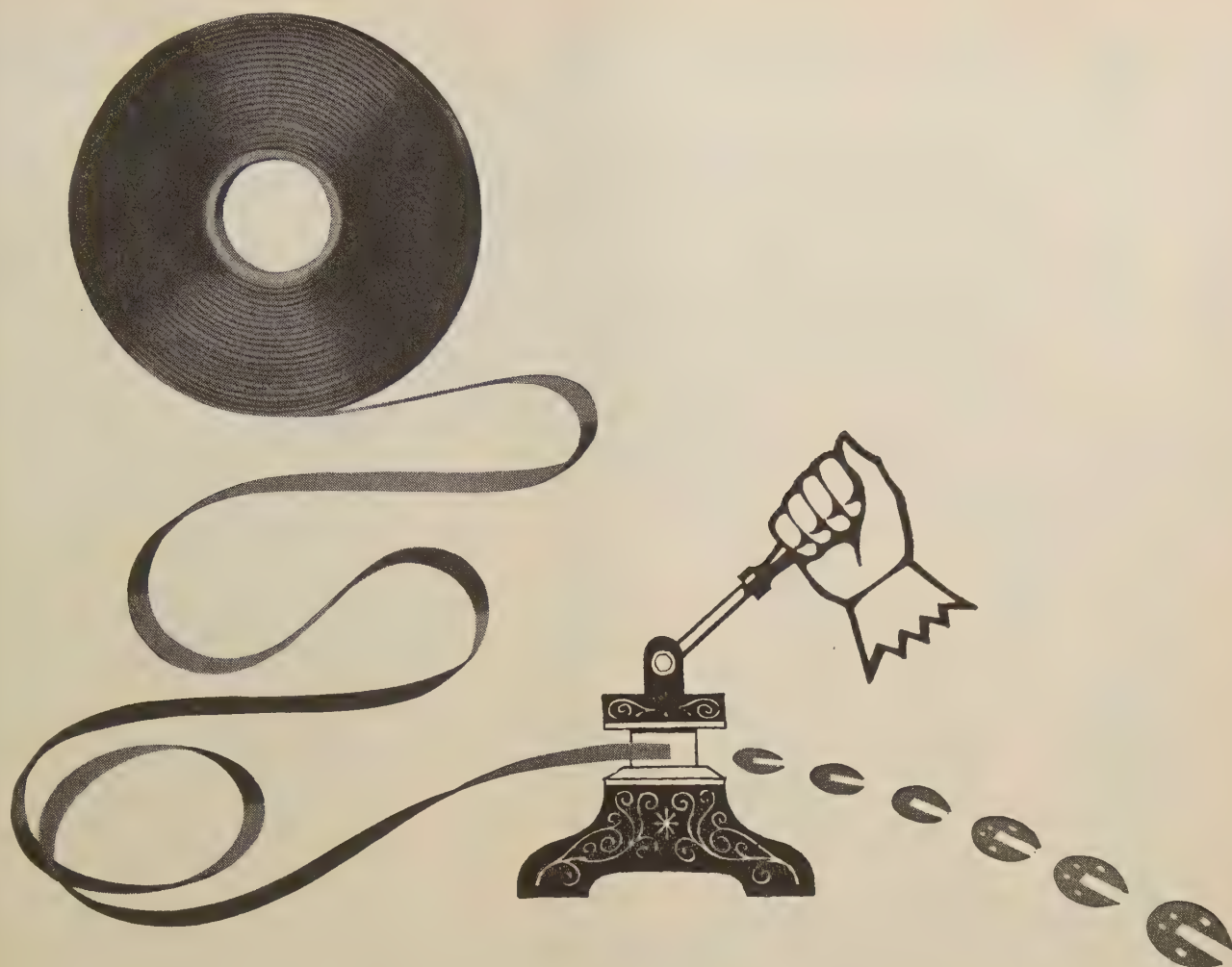
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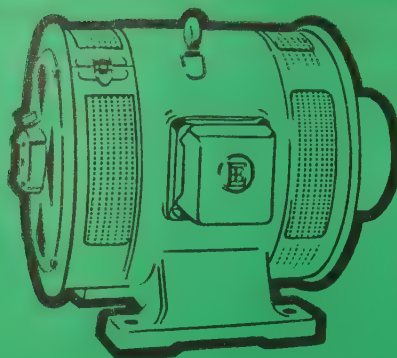
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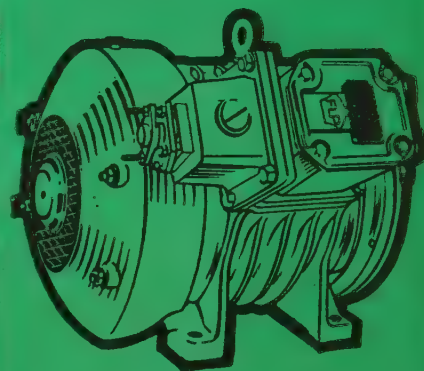
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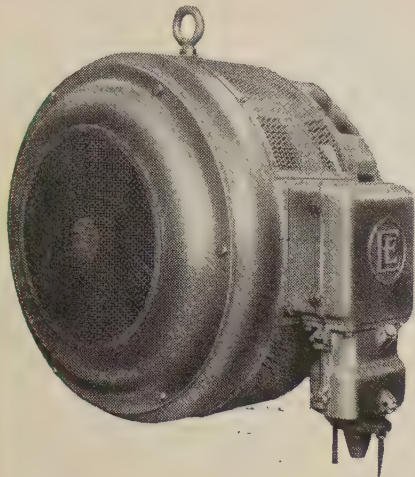
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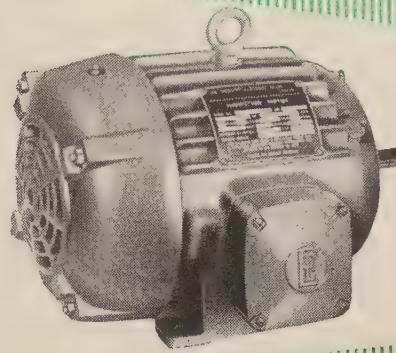
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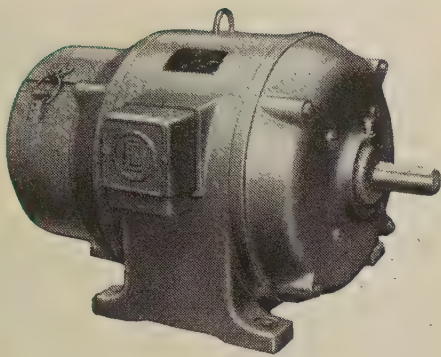




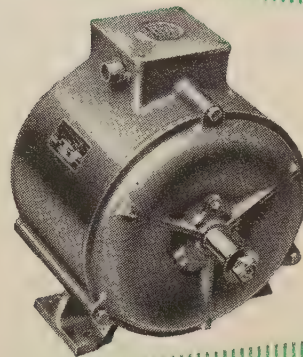
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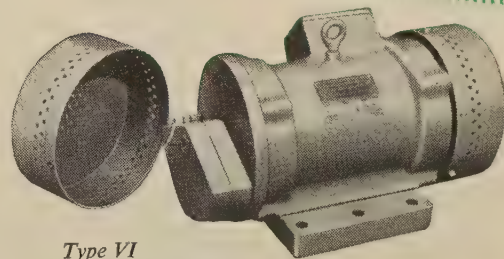


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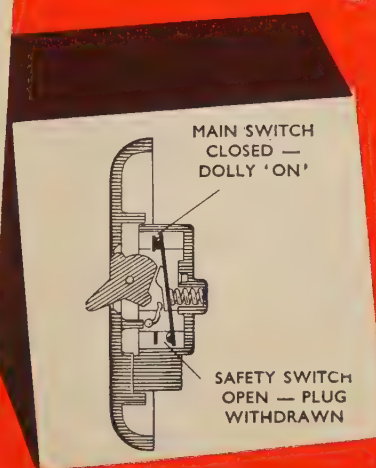
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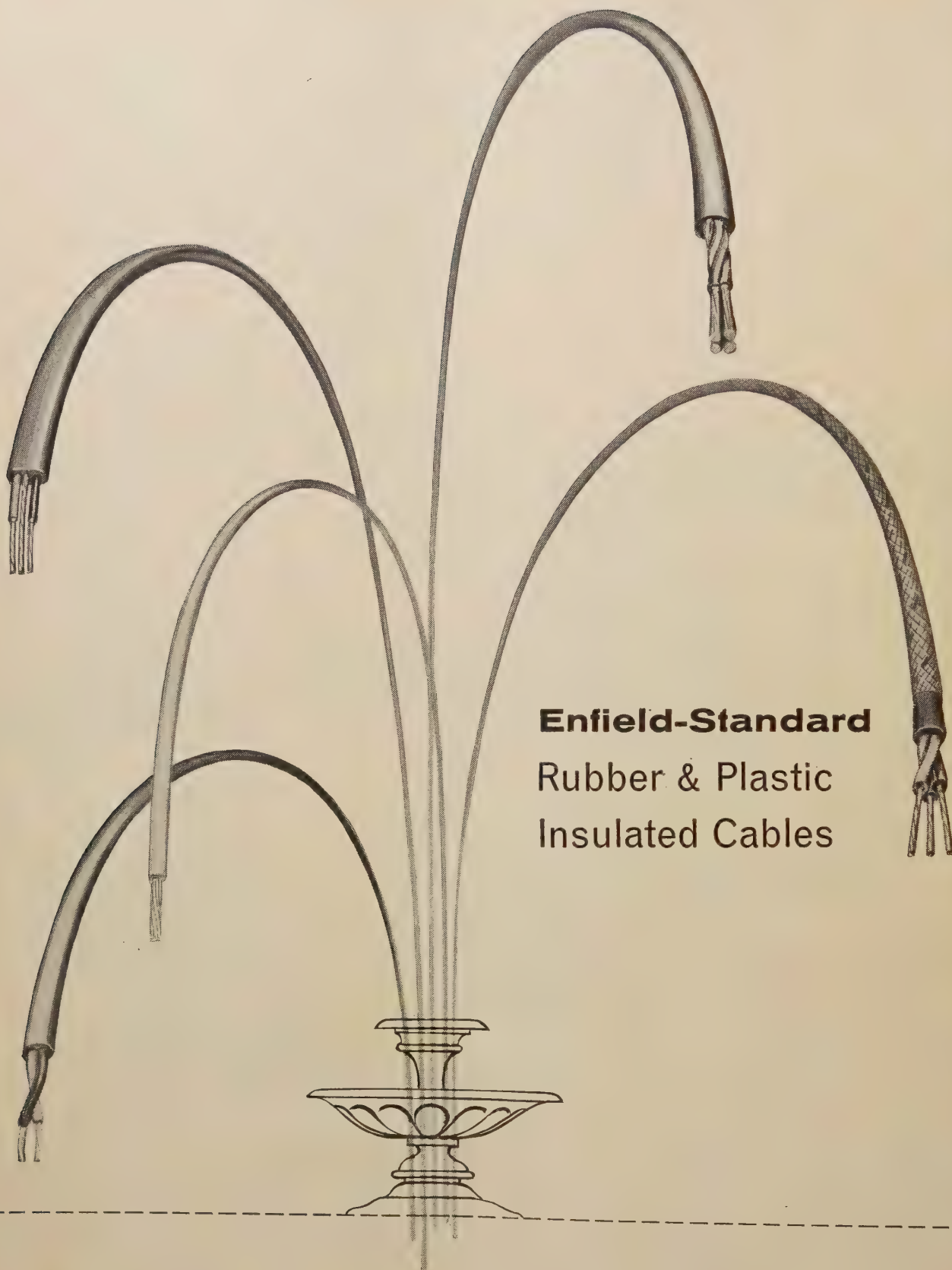
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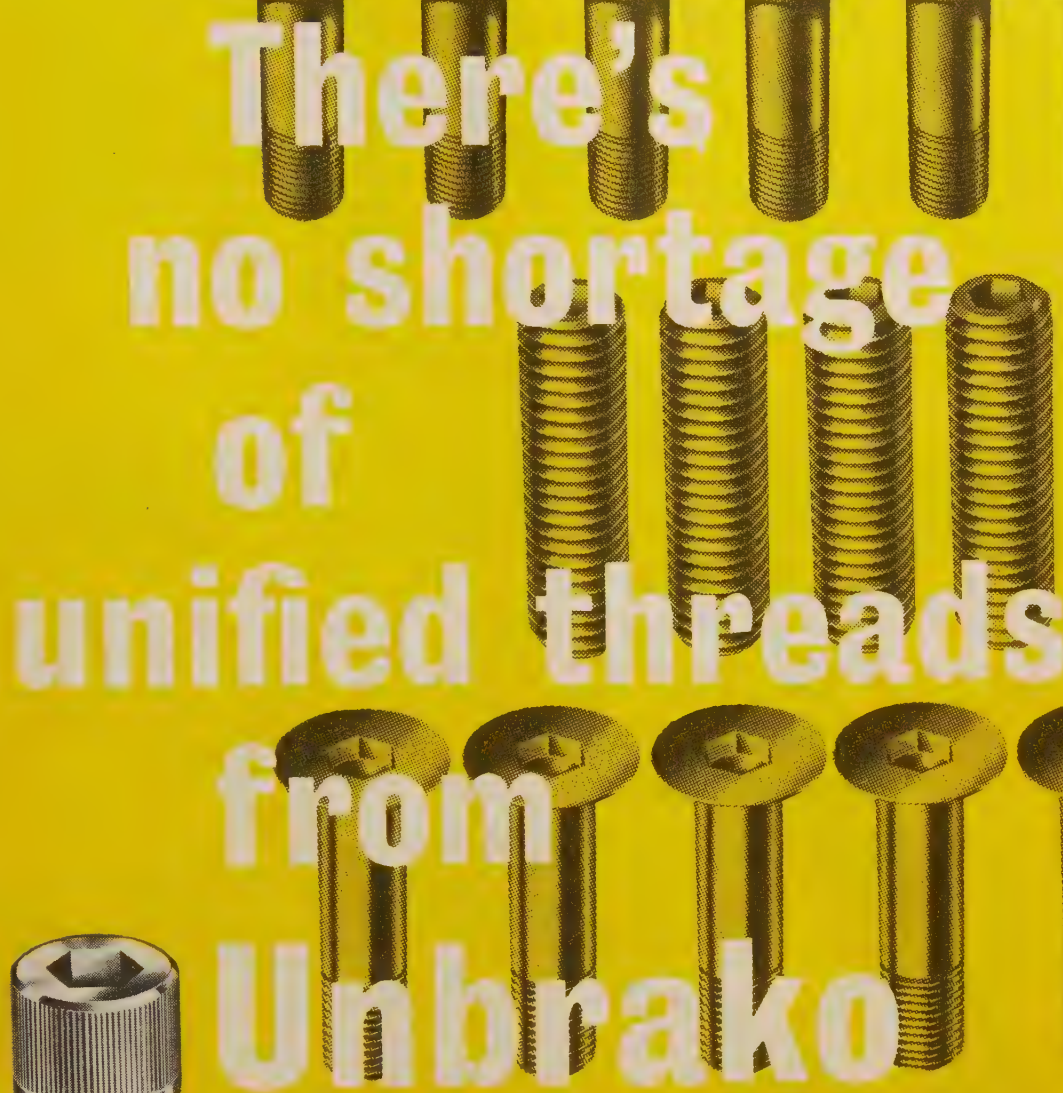


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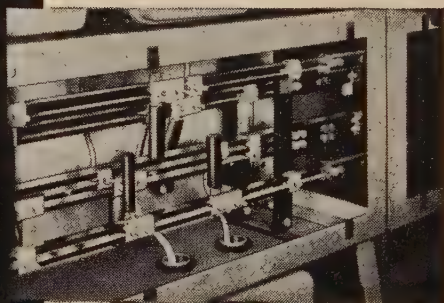
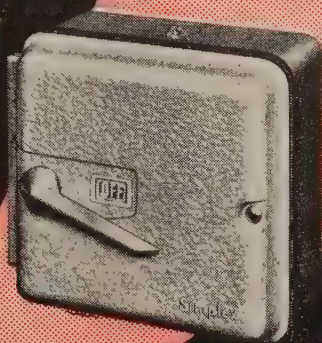
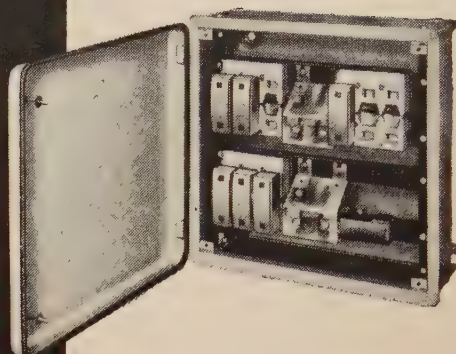
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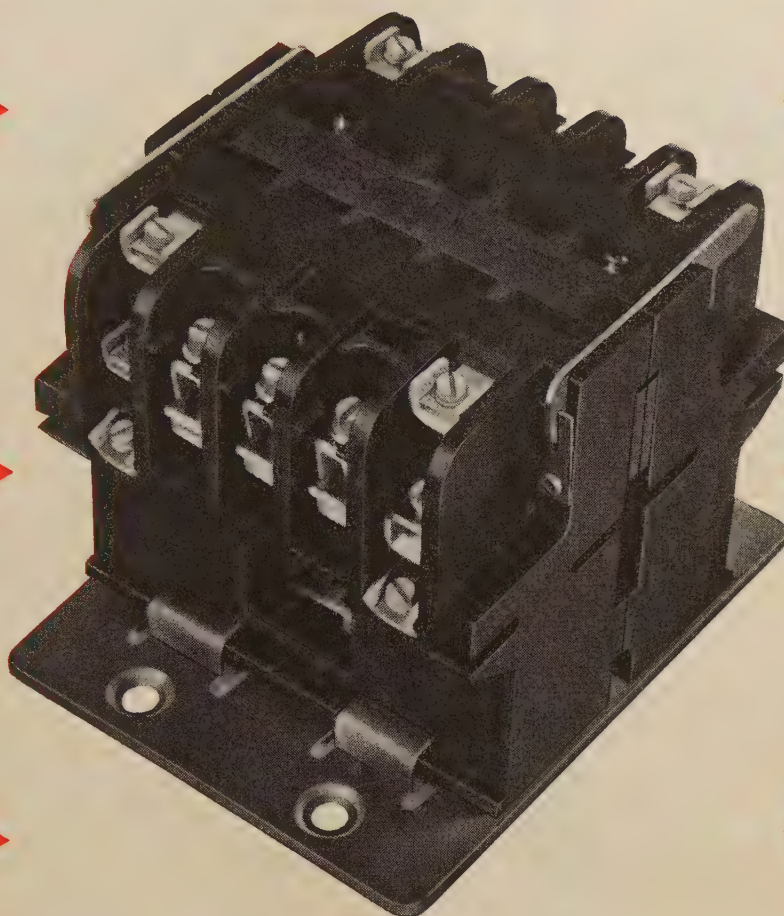
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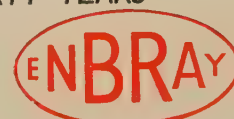
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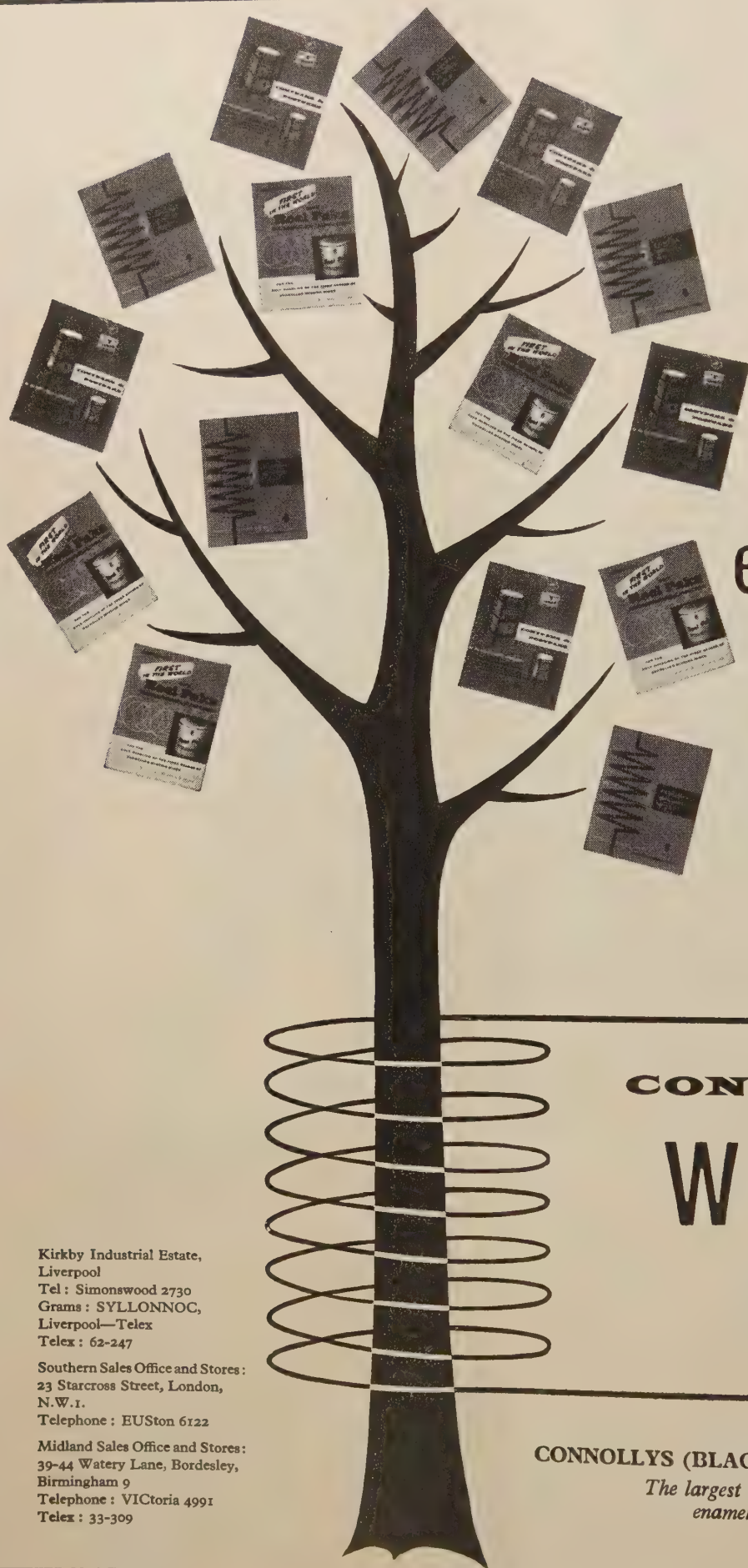
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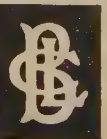
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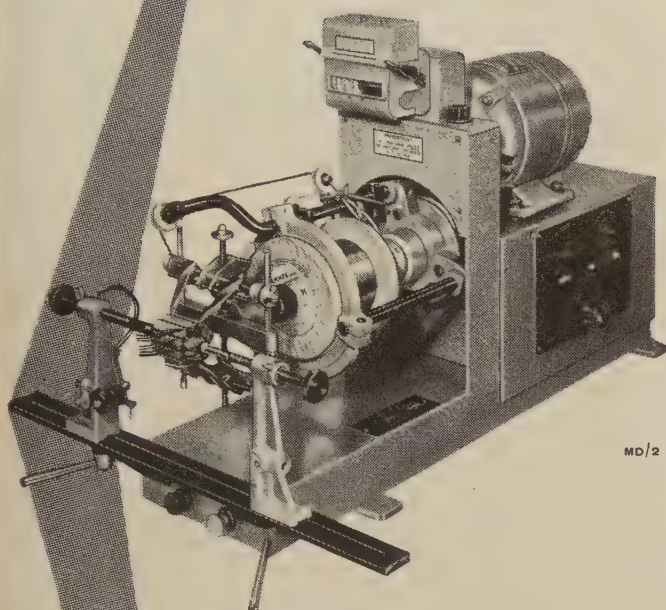


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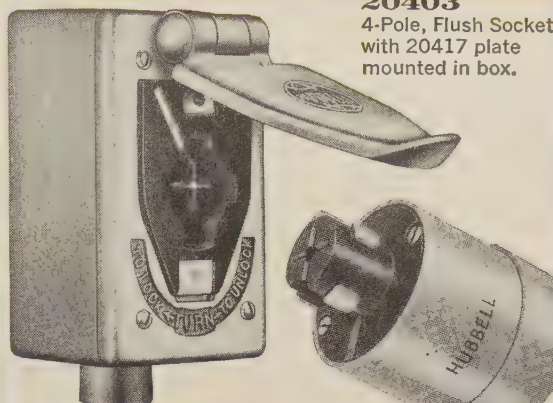
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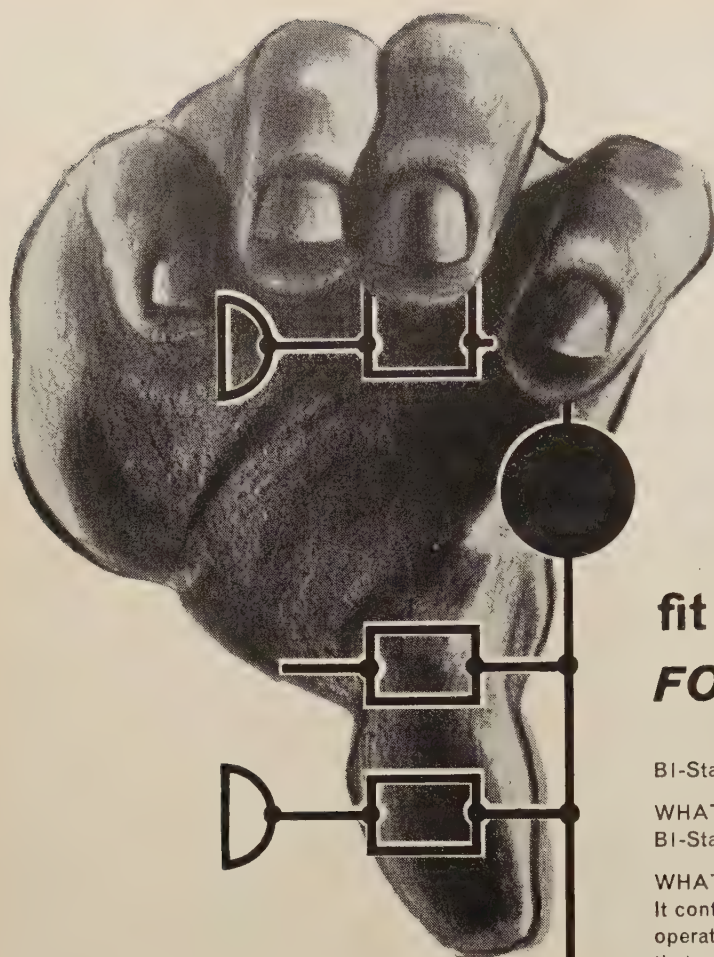
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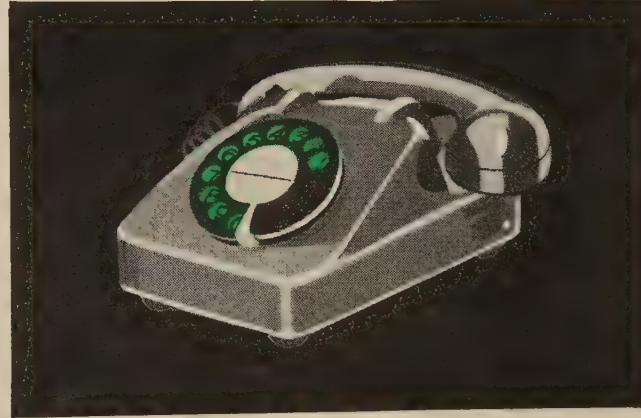
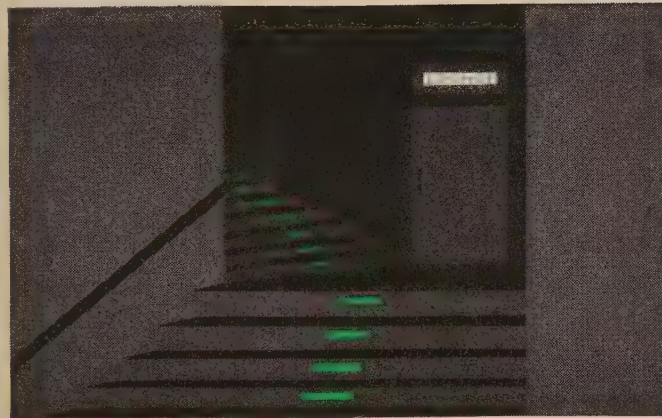
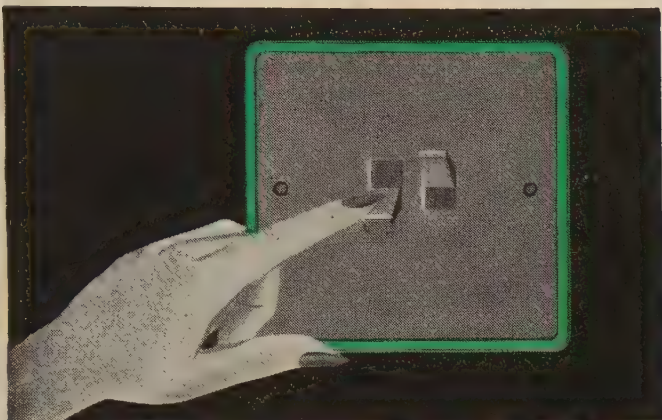
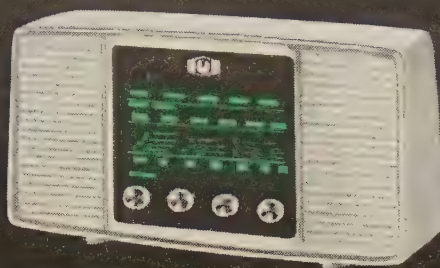
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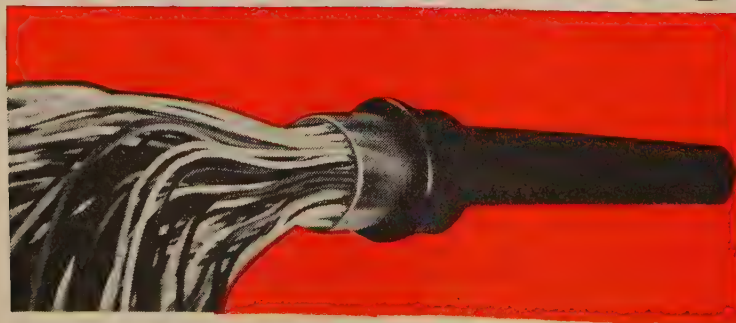


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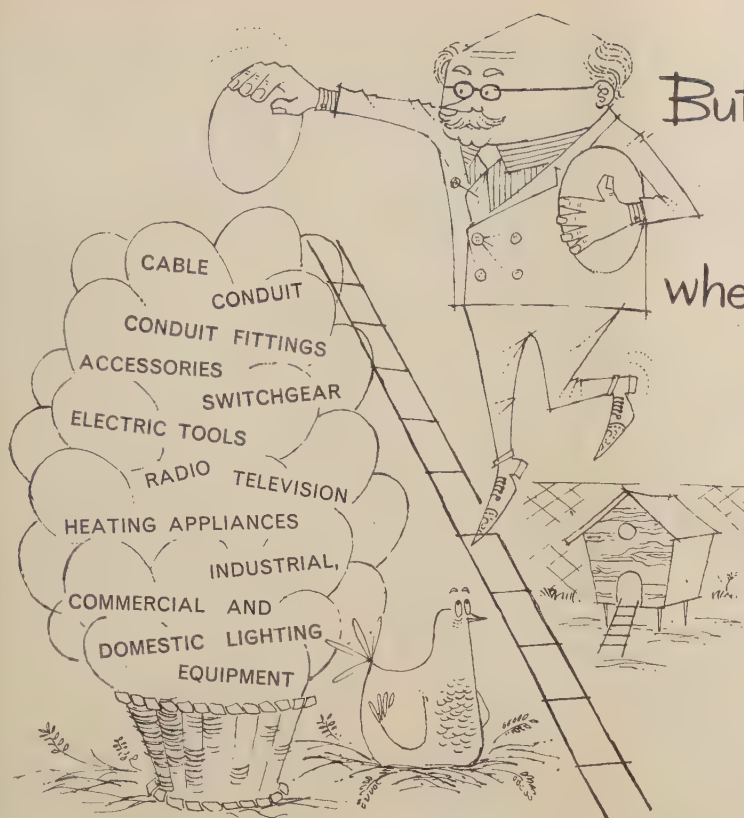
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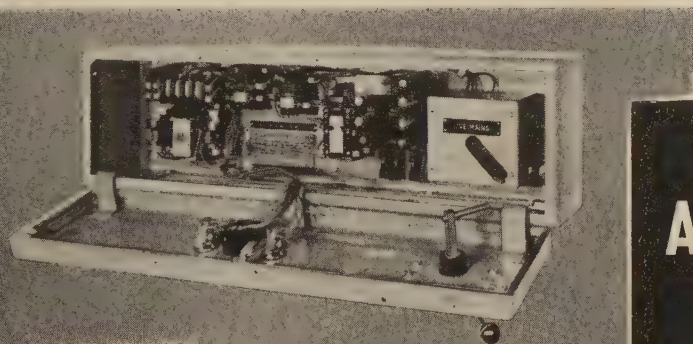
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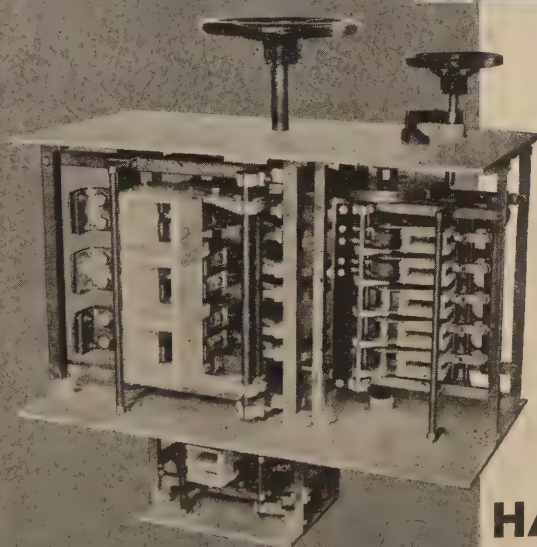
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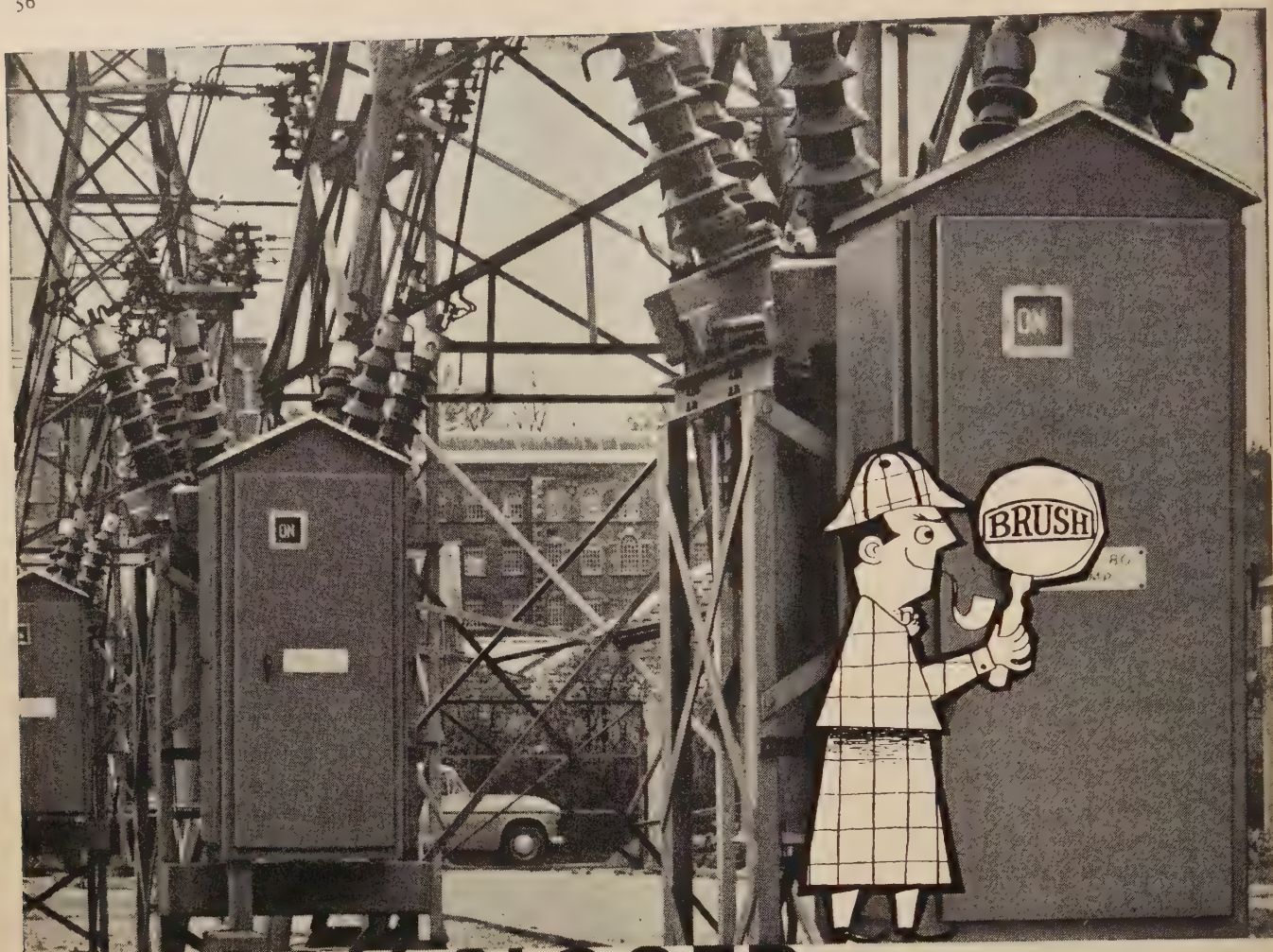
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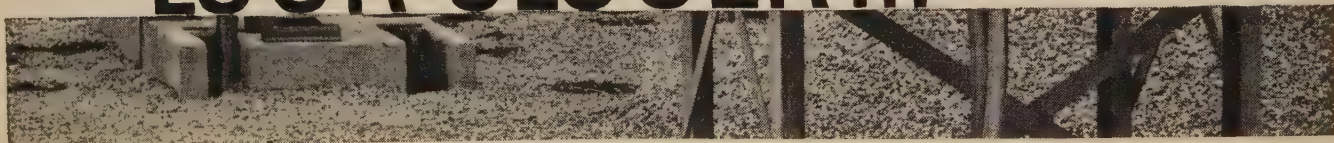
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# ELECTRICAL REVIEW

Friday 24 November 1961 Volume 169 No 21

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# ELECTRICAL REVIEW

24 November 1961 Vol. 169 No. 21 Established 1872

## *Over-Age Installations*

SOMEBODY, some years ago, stated that fifteen years should be regarded as the life of a domestic electrical installation. As the nature of the materials and workmanship varied within wide limits (and still does) this was a bold and somewhat arbitrary pronouncement. In point of fact many installations remain safe and sound for a much longer period, but it has to be admitted that many more do not and that even good installations are too often regarded as eternal. The subject of over-age installations was one of the themes of Sir Robertson King in his address at the recent luncheon of the National Inspection Council for Electrical Installation Contracting. Sir Robertson thought that the Electricity Boards were reluctant to do anything about it but might eventually be forced to take action.

It is worth while considering what steps the Boards could possibly take. There are three broad classes to deal with—local housing authorities, landlords and owner-occupiers. All of them are likely to be satisfied with the installations as they are, until something happens. Local authorities should be the least difficult to tackle. They are public bodies with a duty to their constituents and the Boards could talk to them on level terms. They would probably plead limited financial resources and more urgent claims on them but might still be finally persuaded to re-wire their properties. Landlords are likely to prove less amenable. Unless they can reclaim the cost of new wiring, by way of higher rents, they will not be convinced—and they are probably covered by fire insurance. Their tenants will naturally be reluctant to have the work done themselves and thus improve the landlords' property.

Owner-occupiers, with mortgage repayments to meet, will generally be unable to raise the money for new installations. They, too, will make do with what they have in the way of wiring. But if offered some sort of assistance they might be brought to regard the matter differently.

Before the war a number of municipal electricity authorities ran assisted wiring schemes. They put in installations (most of them rather minimal unfortunately) and recovered the cost by an addition to the "unit" charge. By this painless method they were able to gather in many new consumers, as well as sometimes improving the installations of old ones. So far as one can see the only way in which most superannuated wiring can be replaced is by reversion to some similar plan by the Electricity Boards. They could publicise their willingness to inspect consumers' installations and make recommendations, including suggestions for extensions. Even an unwilling consumer would feel uncomfortable if he did not have any defects remedied



after he had been warned about them. But he still might not be able to meet the cost and it would be then that the Board should be in a position to offer assistance. There are certainly some risks involved in this but the Boards ought to consider it as part of their service and it should ultimately prove remunerative.

## RESEARCH AND PROFITS

Surprise and consternation were caused by a passage in the recent report of the Committee on Scientific Manpower which gave the impression that within the next decade there might be a surplus of scientists and technologists. The subject was raised by Lord Shackleton in the House of Lords last week when Lord Hailsham, Minister for Science, gave an assurance that young people need not hesitate to take up scientific studies. Prospects were wider and better than ever before.

During the debate Lord Taylor made the hardly less surprising statement that finance for research in the electrical industry is being cut. He maintained that research was "one of the first things that an industry tends to cut in order to maintain dividends." He did not reveal the evidence on which he based this judgment but it certainly does not apply to leading electrical manufacturers who are responsible for the major part of the industry's research effort. Unfortunately there are no precise figures for expenditure on research but all the indications are that it continues to increase. It is significant that Mr. T. B. O. Kerr, deputy managing director of the General Electric Co., Ltd., a company which has been passing through severe financial difficulties, has said (*Electrical Review*, 1st September, 1961): "We dare not let up on our long-term research programme and are not doing so."

The pressure on profit margins may, with benefit, make manufacturers more selective in their choice of project and the advantages of further co-operation demand careful attention. But in the end it is the profit to be made out of the successful exploitation of the individual research that remains the main stimulus.

## ONE INSTITUTION?

The suggestion that the Institutions of Civil, Mechanical, and Electrical Engineers should combine to form a single Institution of Chartered Engineers was gaining acceptance, said Sir George McNaughton in his recent presidential address to the Institution of Civil Engineers. This body would be so powerful that the other chartered bodies could not afford to stand outside. Some people did not accept such a bold step but considered that a high-level co-ordinating board would suffice. Sir George was in agreement with this suggestion, not as a final solution, but as a means for the ultimate formation of a single body in the not-too-distant future.

In a letter to *The Times*, the general secretary of the Institution of Chemical Engineers took exception

to the suggestion that the single body would be so powerful that other smaller institutions could not stand outside. This was, he said, "reminiscent of trade union power politics at their worst." Apart from the fact that the functions of an engineering institution cannot be compared with those of a trade union, we feel that Sir George may have trodden on a few toes, but his may be the only way of securing publicly recognised professional status for engineers as a whole.

## I.E.E. DIVISIONS

Following approval at the special general meeting on 2nd November, the present four specialised sections of the Institution of Electrical Engineers will shortly be supplanted by three divisions, an electronics division, a power division and a general division. A report of the meeting, at which the necessary bye-law changes were proposed and approved, was given in our issue of 10th November. At the meeting, one member raised a point of detail and was ruled out of order. It seems that detailed regulations governing the new divisions will not be the subject of bye-laws, but will be drawn up by a committee in the same way as the regulations of the specialised sections have been prepared.

By the replacement of the specialised sections by, in effect, two divisions, one for light current and one for heavy current engineers, the Institution says it will be more fitted to cater for the rapid development of the many aspects of electrical engineering. It is to be hoped that the present delays between the emergence of a new development and its coverage by the Institution will be eliminated by the new structure.

## PARTICULAR AND GENERAL

We said in our issue of 3rd November, in reporting the wage negotiations in the electricity supply industry, that there was ample room for manoeuvre between the employees' demand and the employers' response. And so it has turned out that the compromise which we anticipated has been reached and the threat of a stoppage of electricity supply has been removed.

The Electricity Boards appear to have realised from the start of the negotiations that some increase was justified and they readily offered one, subject to delay by reason of the "pay pause" required by the Chancellor of the Exchequer. Unfortunately that "pause" has been largely ignored outside those public services in which payment by the Treasury is directly involved and the electricity supply men were therefore understandably opposed to the postponement of the increase.

But justification for a rise in one section of industry is now regarded as justification for a general increase. Unless that can be combated the men and women in industry will be no better off; those with inelastic incomes will suffer from the concomitant inflation; and increased costs will still further handicap our export trade.



# MEDIUM FREQUENCY POWER

By L. E. SQUIRE, A.M.I.E.E.\*

Induction heating plant operating at frequencies from 1 to 10 kc/s is being increasingly used in industry. The most common source of supply for such equipment is an induction alternator driven by an induction motor, often made as a combined unit. In this article the author describes the operation of heteropolar and homopolar alternators and their construction, and considers their performance characteristics, with particular reference to neutralising armature reactance and the effect of power factor

**T**HE frequency range from 1 to 10 kc/s is usually regarded as "medium frequency" but it is capable of being extended to include isolated cases at about 20 kc/s. The use of induction heating plant operating in this range is continually spreading in industry, being applied to metal melting, surface hardening, billet heating, and heating for forging and stress relieving. Whilst there are alternative methods of generating medium frequency power for induction heaters, the rotating alternator is the most common, normally driven by an induction motor from the supply mains. Synchronous motors are sometimes used for the larger alternators but their choice is based on considerations of the power supply system and seldom, if ever, on considerations of the medium frequency system. When an alternator is driven from an induction motor its output frequency will vary as the motor speed alters due to changes in the power demand imposed on the alternator, but such frequency changes can be tolerated although the effects must be taken into account in the design of the heating plant.

Medium frequency alternators are now invariably of the inductor type in which there are no electrical windings on the rotor. The excitation windings for the magnetic field are fixed on the stator as are the armature windings in which the medium frequency voltage is to be induced. The rotor is toothed and usually has a different number of teeth from the stator. The movement of the rotor teeth past those of the stator causes flux changes in the vicinity of the conductors and induces an e.m.f. in them. One arrangement is shown in Fig. 1. When the rotor is in position (i) the magnetic flux crossing the air gap to teeth (a) and (b) is at the maximum, whilst that at (c) is the minimum. When the rotor moves through a distance equal to half the pitch between its teeth and arrives at position (ii) the flux at tooth (a) is the minimum, while at (b) and (c) is the maximum. Because the arrangement is symmetrical the total reluctance of the air gap is the same for both positions of the rotor so that there is no change in the total flux crossing the air gap. When the rotor moves from one position to the other a certain portion of the magnetic flux is diverted from one stator tooth to the next and in doing so cuts the stator conductor to induce an e.m.f. in it in a particular direction. As the rotor moves through a further half a pitch of its teeth, the original conditions will be established and the return of the flux to its previous position will induce an e.m.f.

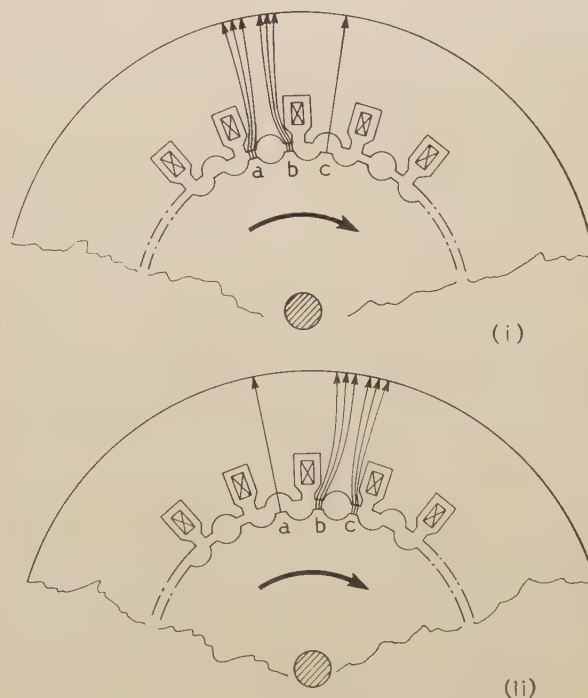


Fig. 1.—No electrical windings are provided on the rotors of induction type medium frequency alternators

in the same conductor in the opposite direction. Thus one complete cycle of alternating e.m.f. will be induced in the stator conductor each time that the rotor moves through a distance equal to the pitch of its teeth so that the generated frequency will be the product of the speed of the rotor and the number of its teeth. Since the total flux remains unchanged and the only variation is in and near the teeth, it is only necessary for the field system to be laminated in these areas, while the remainder of the magnetic circuit need not be laminated.

## Field Windings

The field windings may be arranged in either of two different principal ways resulting in what are known as "homopolar" or "heteropolar" machines. The principle of the homopolar alternator is shown in Fig. 2 in

\* Electric Resistance Furnace Co., Ltd.



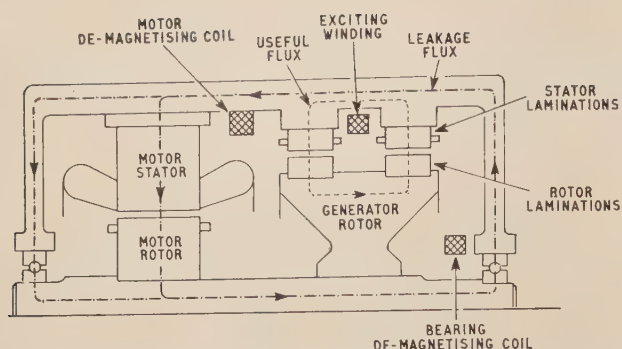


Fig. 2.—In homopolar alternators the stator is built in two parts with the excitation winding between them, and in many cases the machine is in a common frame with its driving motor

which the stator is built in two equal parts with the exciting winding placed between them and co-axial with the shaft. There is only one field winding and the path of the main flux produced by it is indicated. In addition, however, there will be a leakage flux passing through the frame, endshields, and shaft as shown by the chain-dotted line. This leakage flux can induce current in the shaft and in the bearings with the risk of overheating the bearing and the possibility of pitting of the bearing surfaces. The leakage flux must be kept to the minimum. In some designs the rotor shaft is made of non-magnetic material, in others the end-shield for the bearing is of non-magnetic material. Some designers employ sleeve bearings with non-ferrous shells. When the leakage flux is high due to the presence of magnetic materials, a de-magnetising coil may be positioned near the bearing and excited so as to neutralise the leakage flux. The de-magnetising coil is usually connected in parallel with a resistor for adjustment and the whole connected in series with the main field winding.

In many machines the alternator is built in a common frame with its driving motor and the two rotors are mounted on a single shaft as indicated in Fig. 2. In such cases the leakage flux can pass from the alternator through the frame and through the laminations of the motor. This flux, being unidirectional, will distort the magnetic field produced by the motor, adding to it in one part and subtracting from it in another, which may result in mechanical pulsations of undesirable magnitude. This leakage flux can be minimised by the use of a demagnetising coil in a similar way to that for the bearings, but in this instance the coil will be positioned near the inside periphery of the frame.

The heteropolar alternator has the field winding accommodated on the stator laminations and the paths of the magnetic flux are as indicated in Fig. 3. The field coils most commonly embrace an arc of  $90^\circ$  to produce a four-pole field or an arc of  $60^\circ$  to produce a six-pole field but other arrangements are, of course, possible. With this arrangement there needs to be only one stator and one rotor, while there are no complications due to flux leakage along the shaft.

### Performance Characteristics

The two methods of construction have different performance characteristics. In the homopolar machine a considerable length of the flux path consists of material chosen for its low cost and mechanical properties rather

than for its electrical or magnetic characteristics. This usually results in a high magnetic retentivity so that the machine generates a relatively high residual voltage when the excitation is removed. If this voltage is objectionable it can be minimised by applying a reverse current to the field. Since a considerable portion of the path of the flux is through solid metal then it follows that eddy currents will be induced in the mass of metal when the flux is changed. These induced currents oppose the change of the flux and thus slow down its rate of change when the excitation is altered. The result of this is a slow change of output voltage for a change in excitation. In a large machine there might be a delay of several seconds between the time of interrupting the excitation and the reduction of the voltage to its residual value. This condition is often undesirable, especially when automatic switching operations are to be performed, so that it sometimes becomes necessary to resort to the complication of reversing the field current until the voltage approaches a sufficiently low level and then finally interrupting the field current. The same phenomenon militates against the use of a simple type of automatic voltage regulator so that to obtain a suitable response it may be necessary to employ field forcing and reversing.

The open-circuit characteristic of a homopolar alternator is shown in Fig. 4, from which it will be seen that the

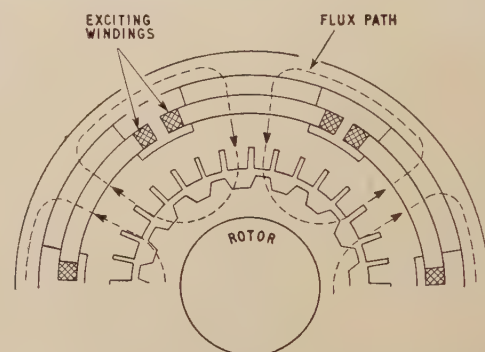


Fig. 3.—Field windings of heteropolar alternators are accommodated on the stator laminations

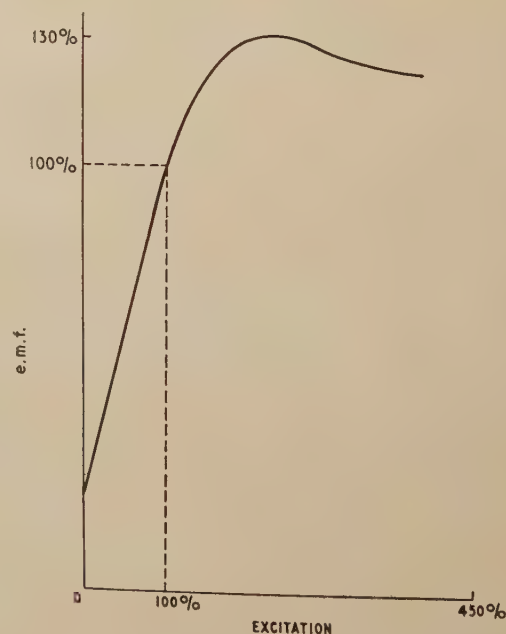


Fig. 4.—Homopolar alternator open circuit characteristic



voltage not only ceases to increase when the excitation current is increased beyond a certain value but it actually decreases. This is because magnetic saturation takes place in parts of the teeth of the stator and rotor so that the changing positions of the rotor teeth do not result in so great a change in reluctance as is the case when the teeth are not saturated.

The characteristics of heteropolar machines are generally similar but not quite so pronounced because the air-gap is usually greater than for homopolar machines of equivalent size and this tends to flatten the curve. Since practically all of the iron-path of the flux is through laminations of high quality material chosen for its magnetic and electrical properties, the voltage quickly responds to changes of field current so that simple regulators can usually give satisfactory automatic control of the voltage. The residual voltage is usually low, of the order of 5 per cent or less.

### Construction

The early sets employed in industry consisted of a separate motor directly coupled to a generator and mounted on a bedplate common to the two machines. Sometimes, there were combined machines for the smaller sizes as seen in Fig. 5. They were of the enclosed ventilated pattern and since they were mostly used for melting furnaces in foundries it was not considered a hardship to provide a room for the enclosure of the machines and for most of the electrical equipment. They usually ran at two-pole speed and were necessarily designed with internal fans that passed large quantities of air through the machine to ensure effective cooling. This resulted in a need for frequent cleaning to keep the windings and the cooling passages free from accumulations of dirt deposited from the dusty air. Room ventilating fans were next provided to move air from outside the building into the machine room to keep it at a positive pressure to prevent the ingress of dust-laden air from the adjacent foundry. In many instances, however, this was only a partial solution because machine rooms were often sited in dirty industrial surroundings so that a considerable amount of dirt was still being passed into the machine room. The addition of air filters for the incoming air was the obvious next step, using cell type filters for small installations and automatically self-cleaning types for large installations. Large machines often had the exhaust ducts built into the foundations communicating with the air outside the building. In very cold climates the hot air discharged from the machine may wholly or partly be recirculated for warming the machine room, while a plenum control may be provided to deal with the supply of fresh air. Fig. 6 shows a 1,250 kW set of this type.

### Water Cooling

The extending use of induction heating for surface hardening involved the development of generators for frequencies of 9,600-10,000 c/s and, owing to the very high power loss in the iron at this frequency, there arose a greater problem of removing heat from the machine. An early step was to provide the enclosed ventilated machine with cooling for the stator iron by water-cooled copper plates built between the stator laminations and in contact with them. In damp atmospheres insulation trouble could arise because of the condensation of moisture



Fig. 5.—Early combined motor and generator

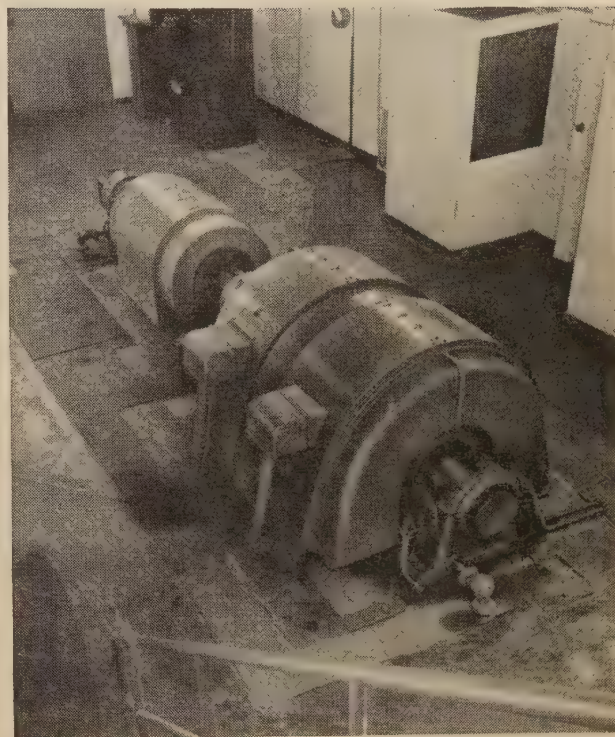


Fig. 6.—Hot air discharged from this 1,250 kW set is used for machine room heating

on cold areas during shut-down periods, but this was avoidable by ensuring that the supply of cooling water was stopped as soon as the driving motor and generator excitation was switched off. Owing to the fact that the stator was more effectively cooled than the rotor the latter would expand relatively to the stator as the temperature increased. Since the air-gap on this type of generator is made as small as mechanical considerations will permit,



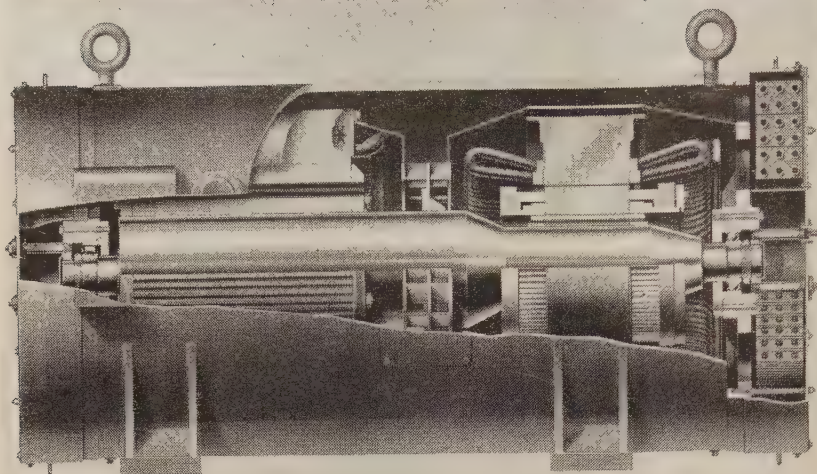


Fig. 7.—Cut-away section of a Westinghouse totally enclosed machine with internal air circulation and water-cooled heat exchangers

it follows that any expansion of the rotor relatively to the stator and decreasing the air-gap will cause a large change in the reluctance of the field circuit and can have a profound effect on the open circuit voltage characteristic of the machine. Although this might introduce difficulties with voltage control the disadvantage was not a serious one because the early applications were not such as to demand accurately maintained voltages.

When the applications of surface hardening became developed in such a way that induction heating could be used in flow-line methods of production it was no longer practicable to provide rooms in which to accommodate motor-generators. The need for economising space encouraged the building of a motor and generator in a single housing. The rotor of the generator was mounted on the same shaft as that of the motor and it could be carried in a bearing at each end of the machine so that a very compact unit could be obtained. The smaller sizes were air-cooled but built into an enclosure with replaceable air filters for the inlet, the hot air being discharged into the factory. Larger machines were made totally enclosed with internal air circulation and built-in water-cooled heat exchangers. Fig. 7 illustrates a typical machine. Such machines needed exceptionally rigid shafts to carry the weight of the two rotors when there was a long span between the bearings. By careful dynamic balancing and by supporting the machines on shock-absorbing mountings it was possible to build very satisfactory high-speed units up to a few hundred kW output with a noise level low enough to be acceptable in a normal machine shop. Some objections were raised to this design on the grounds that the bearing loads were high, which implied a short life for ball or roller bearings, and it was held that in the event of a bearing failure at least the stator of the generator would become a total wreck. Some makers build these units with sleeve bearings having liners of white-metal and provide them with devices to give warning as well as to trip the motor starter in the event of bearing trouble. Some units are built with external water-cooled heat exchangers connected with the machine by air ducts, and are thus rather bulky.

Other makers designed vertical units with internal air circulation and self-contained water-cooled heat exchangers

which occupied even less floor space than the most compact horizontal machine. A typical arrangement is shown in Fig. 8. This type of machine should be cheaper than the horizontal design and it is claimed that the bearings should have a longer life since they can be larger and carry lighter loads. It is also claimed that a bearing failure is not likely to lead to serious damage to the machine. Provided there is sufficient headroom above the machine the vertical type is easier to dismantle for internal inspection and repair than the horizontal design. With horizontal machines, however, the bearings can be serviced and replaced without removing the rotor, but in the vertical machines it is a major operation to gain access to the lower bearings. With some designs the

noise level was considerably higher than for the horizontal type and in some instances could not be accepted in the working area of the factory. The paradoxical situation then arises of machines which were designed with cooling systems to avoid the need for separate enclosures now having substations built to house them.

### Rating Designation

Alternators in the medium frequency range have a high internal reactance so that the synchronous impedance is considerably greater than is experienced with machines at normal power frequencies. The value of the synchronous impedance varies considerably with the type of alternator, its size, frequency and the particular design. The synchronous impedance is expressed as the percentage of

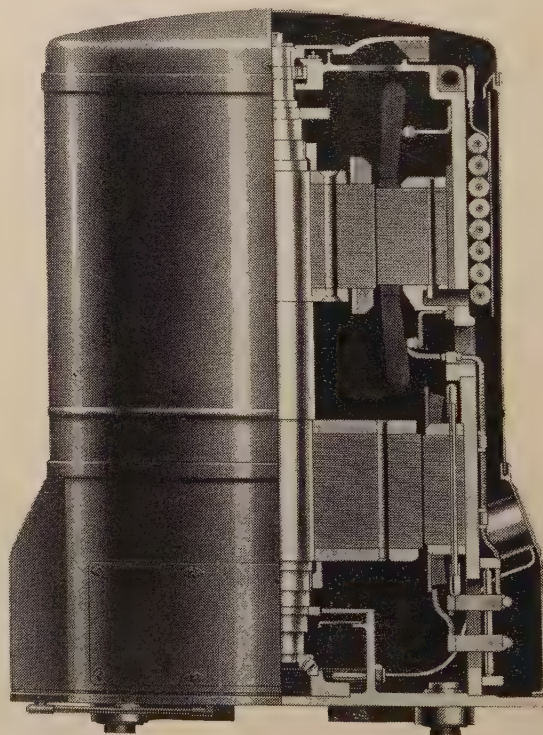


Fig. 8.—Half sectioned view of an A.E.I. m.f. vertical spindle motor alternator, a type involving reduced floor space and less heavily loaded bearings



rated voltage required to be generated in the windings to cause full-load current to flow in the armature when it is short-circuited with a link of negligible impedance. Typical values of synchronous impedance lie between 65 and 130 per cent. The resistive component of the impedance is relatively small and may be neglected for the present purpose, so that the synchronous impedance may be considered as a wholly inductive reactance.

Because of the high synchronous impedance, the voltage drop internal to the alternator is high, requiring a high excitation current tending to limit the output available from the machine. Fig. 9 shows the performance of a particular alternator when connected to a unity-power-factor load having a resistance corresponding to the nominal rating of the machine. It can be seen that if the machine is connected to its rated load then it is impossible to obtain the rated output. From this point of view the rating of the machine in terms of voltage and current is misleading.

The operating limit of the machine is, of course, its temperature rise. This in turn is determined by the excitation and by the armature current. Such considerations might suggest that the maximum permissible armature current and the maximum field current would be a better criterion of the capacity of the machine. But the iron loss is also related to the power factor at which the machine operates, so that a better criterion than the field current might seem to be the e.m.f. generated in the windings. However, neither of these alternatives has much practical value and is not very informative to the user whose primary concern is with supplying a certain load rather than with what is happening inside the machine. When it is realised that apparatus additional to the alternator is necessary so that the machine may be used in a reasonable manner, it would seem that the rating should be stated as the permissible output obtainable from the combination of the alternator and the particular auxiliary apparatus considered as a single unit. It would seem that only in this way would a rating in terms of voltage and current have practical significance.

### Series Capacitor

To obtain the rated output from an alternator of this type, it is clearly necessary to neutralise the effect of the armature reactance. The most common and most convenient way of accomplishing this is to connect a capacitor in series with the output from the machine. It is then possible to make the reactance of this series capacitor equal to the inductive reactance of the alternator. In this way it is possible to neutralise completely the inductive voltage drop, thus enabling the maximum output to be obtained from a particular frame size. The output voltage of the combination would be practically independent of the magnitude and nature of the load. Whilst this seems desirable it brings other disadvantages. If a short-circuit occurs near the terminal of the set (after the series capacitor) the current would be limited only by the very low ohmic resistance of the circuit, so that a large current would result. This current flowing through the inductance of the alternator windings would cause a very high voltage to appear across it, and the same current flowing through the series capacitor would cause a very high voltage to appear across this also. In this way there is a serious risk of failure of the alternator insulation as well as of the series

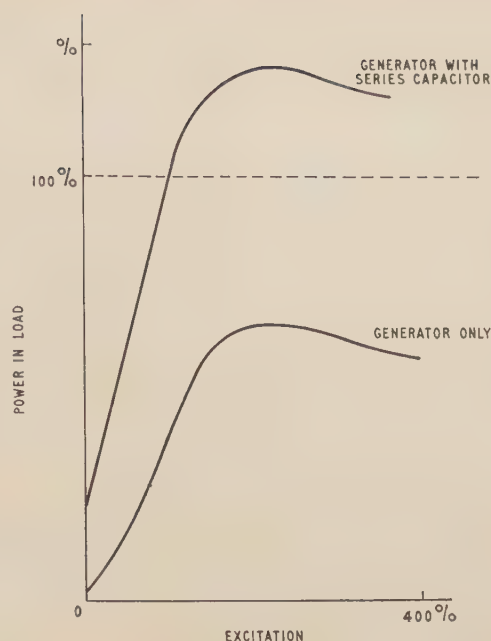


Fig. 9.—Alternator performance when connected to a unity power factor load having a resistance corresponding to the nominal rating of the machine, both with and without a series capacitor

capacitor unless they were both insulated for very high voltages at a correspondingly increased cost. It is, therefore, advisable not to attempt complete neutralisation but to leave a selected amount of reactance for the purpose of limiting the short-circuit current.

This can be done by making the capacitive reactance lower than the inductive reactance, when the machine is said to be under-compensated; or by making the capacitive reactance the higher, when the machine is said to be over-compensated. A machine is often said to be, say, "80 per cent compensated" when it is provided with a series capacitor whose reactance is equal to 80 per cent of the full-load synchronous reactance. But this does not convey any useful information to the user unless the value of the synchronous reactance itself is also stated and this is seldom done. It is also inclined to be misleading, because to state "80 per cent compensated" implies 20 per cent uncompensated and can easily be mistaken to mean that the combination of generator and series capacitor has a resultant of 20 per cent reactance. This is by no means the case, for if a machine having a reactance of 150 per cent is 80 per cent compensated the resultant reactance is 30 per cent. If one having a reactance of 50 per cent is similarly compensated the resultant is then only 10 per cent.

The performance of the generator with a series capacitor is also shown in Fig. 9, from which it can be seen that the full power may easily be obtained in the load.

### Type of Compensation

From the point of view of the external performance of the combination it might seem that under-compensation and over-compensation are equally effective. Such a view would lead one to provide under-compensation since the series capacitor would be the smaller and the cheaper of the two alternatives. However, this would be sound practice only if the reactance of the machine did not decrease to any appreciable extent, but in practice it



changes considerably, falling with increasing current and with increasing excitation due to the effects of saturation in the iron, especially in the teeth. Under short-circuit, high current, conditions, the synchronous reactance will be lower than at normal load so that if the machine has been under-compensated at full load it may turn out to be fully compensated at overload or fault conditions with the consequent risk of the fault current being very high, which is the condition to be avoided. Over-compensation, therefore, appears most desirable because the effective over-compensation becomes greater under short-circuit conditions and consequently the possible short-circuit current is more limited.

This, of course, assumes that the fault is close to the machine and its series capacitor. If the equipment is feeding into a transmission line and the short-circuit occurs at the remote end of the line then the impedance of the line must be taken into consideration. The transmission line may usually be considered as wholly inductive and it might well be that the reactance of the line added to that of the alternator could become equal to the reactance of the series capacitor so that the short-circuit current would once again only be limited by the resistance of the system. Thus, consideration should also be given to the *external* circuit conditions when selecting a series capacitor.

### Effect of Power Factor

Under most working conditions the power factor of the load is likely to be other than unity and will usually vary from lagging to leading. The effect of this can be seen from the vector diagrams of Fig. 10, which refer to an over-compensated machine. The vector *OI* represents the current in the load and *OE* the voltage at the load so that  $\cos \phi$  will be the power factor of the load. *OA* represents the voltage across the capacitor which, when added to the load voltage, gives *OB* as the voltage appearing at the terminals of the machine. The voltage across the inductance of the machine is *OC* which, when added to *OB*, gives *OD* as the e.m.f. generated in the windings of the machine.

In the case of the lagging power factor, shown at (a), the

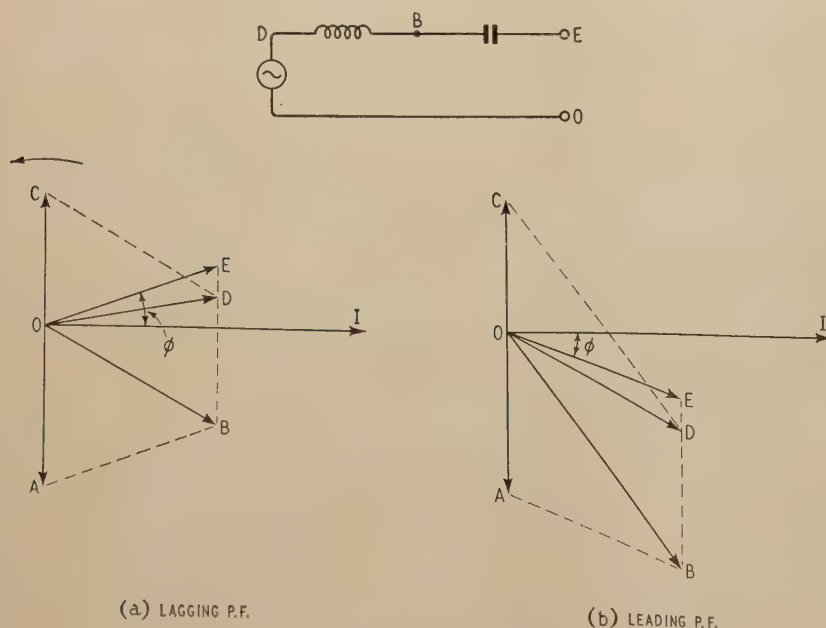
induced e.m.f. in the windings is a little less than the voltage at the load, while the terminal voltage of the machine is very similar to that of the load. The case of the leading power factor shown at (b) brings out more clearly the fact that the terminal voltage at the machine can be appreciably greater than the voltage at the load so that it may be necessary for the leads to the series capacitor to be insulated for a higher level than the rated voltage of the system. Sometimes the series capacitor is divided into two parts, one being connected in each of the lines from the generator. This might occasionally have practical conveniences but it does nothing to alleviate the problem of high voltage connections between the machine and the series capacitors. It is sometimes held that the arrangement balances the stray capacitances to earth but the point is usually only of theoretical interest as its magnitude is seldom of practical importance in the type of installation being considered.

A further variation is for the machine windings to be divided into two equal parts intended to operate in series. The series capacitor is then electrically connected between the two parts of the winding. The arrangement has the advantage that the leads from the output terminals of the generator only have the load voltage between them while the connections to the capacitor only have the capacitor voltage between them. If the series capacitor is housed some distance from the generator then an appreciable additional amount of cable can be needed by reason of this arrangement.

### Series Resonance

This condition is always obtained when the inductive reactance is equal to the capacitive reactance and is not necessarily undesirable. In some working conditions it is possible to experience a sudden increase of current to a very high value resulting in the generator being switched off by the operation of the over-current releases. The phenomenon is correctly attributed to series resonance but is often endowed with a mystery that it does not deserve.

When the generator is operated with a set excitation current and its loading is within its normal kVA rating but has a low power factor, the condition of series resonance can occur as the load changes. The load conditions can be represented by a reactance in series with a low resistance. If the generator is over-compensated by its series capacitor and if the load has a lagging power factor, then it is possible that the inductive reactance of the load when added to the reactance of the machine could equal the capacitive reactance. This can also be assisted by the fact that the reactance of the machine also increases at low load. Since the ohmic resistance of the circuit is low then the voltage generated by the fixed excitation of the generator will be sufficient to send a very high current round the circuit when the load so changes that the resonant condition is obtained. If the generator is under-compensated then similar conditions will occur when the load has a leading power factor.



(a) LAGGING P.F.

(b) LEADING P.F.

Fig. 10.—Effect of power factor with an over-compensated machine



To illustrate this effect one may examine the generator whose characteristics are shown in Figs. 4 and 9 when it is 80 per cent compensated by the reactance of the series capacitor being 25 per cent greater than the inductive reactance of the generator. This combination would be brought into resonance with a full-load power factor of about 0.9 lagging. The full-load conditions would be obtained at 100 per cent excitation but even if the field current was increased to permit the maximum e.m.f. to be generated, the maximum current in the load would only be about 130 per cent so that there is no danger in this condition.

If the generator was connected to a load having a power factor of 0.15 lagging the excitation would be adjusted to permit not more than full-load current to flow. If the

resistive component of the load remains constant while the load power factor changes to about 0.3, through a reduction in the inductance of the load or because capacitance has been added to the circuit, then the system will be resonant. The effective resistance of the load will be small and even if no excitation was applied to the generator the load current would be about 25 per cent due to the residual voltage, so it is clear that with the excitation set for a working voltage the current could be very high. It is thus necessary to avoid conditions which could give rise to resonance when the power load is small.

In these examples it has been assumed that the generator reactance is constant whereas it increases at low loads so that this effect as well as transmission line impedance needs to be taken into account in practice.

## FARADAY LECTURE

Summary of the 33rd Faraday Lecture arranged by the Institution of Electrical Engineers which was given for the first time in Bristol on 21st November. It will be repeated in various centres, including London on 14th February, 1962. The lecture is entitled "Expanding Horizons in Communications" and the author is Mr. D. A. Barron, M.Sc., M.I.E.E., Deputy Engineer-in-Chief, General Post Office

**T**HE modern world depends vitally on communication; not the least among the many means of communication between peoples is the world-wide telephone and telegraph system. Remarkable as the achievements in telephone and telegraph communication have been in the past, the horizons of what is yet achievable are still expanding.

In the 1961-1962 Faraday Lecture, the means available for automatically interconnecting any two subscribers are reviewed, with demonstrations of the principles of local, national (subscriber trunk dialling) and international automatic switching. The ways in which a local telephone connection can be built up progressively into a world-wide telephone system controlled entirely by the subscriber are explained.

The means for interconnecting telephone and telegraph exchanges, both within a national network and internationally, are discussed, with demonstrations of how the complex requirements of the caller are signalled from point to point at high speed as a call is set up. The development of cables is reviewed; at first, cables could carry only one conversation for each pair of wires. Then, by making use of the electrical properties of cables and the tolerance of the human ear, it became possible to carry several conversations simultaneously on each cable pair, entirely without mutual interference. The ever-growing demands for still greater capacities for traffic between towns, cities, countries and continents resulted in the development and perfection of new types of cable and new equipment that nowadays can carry thousands of conversations simultaneously, including television programmes, in place of the 100 or so telephone conversations previously possible over ordinary cables.

The high cost of large-capacity cables, with their closely spaced amplifying stations, in turn encouraged the development of multi-channel radio systems operating with radio

beams directed from point to point in the manner of searchlights: interconnecting cables are not needed, only a sufficiency of radio-repeating stations along the route. These systems also provide a large capacity for telephone and telegraph working and capacity for television programmes. Still the capacity of inter-city systems is not enough, and attention is now concentrated on the development of hollow metal tubes for guiding electric waves from the sending to the receiving point. These tubes have a potential capacity for simultaneous conversations, even simultaneous television programmes, far exceeding anything presently available.

Intercontinental communication, at first dependent primarily on radio transmission systems of small traffic capacity and variable performance, are now steadily being supplanted by undersea telephone cable links containing highly reliable built-in amplifying units every 30 miles or so along the sea bed. The demand for traffic capacity remains insatiable.

New undersea cables are extremely costly and take a long time to prepare and lay, and attention has been directed towards improving the capacity of existing cables. The solution makes use of the fact that in any conversation only one direction of transmission from talker to listener is normally in use at any one time and even then is not fully occupied, owing to pauses, etc. A telephone cable system must provide a speech channel in both directions (e.g. across the Atlantic); if, therefore, the occupation of channels can be restricted automatically to the time for which speech is actually present in either direction, without affecting the users' impression of both-way conversation, the capacity of the cable for simultaneous conversations may be approximately doubled. This system is demonstrated; it is in daily use across the Atlantic. In conclusion, reference is made to the next development step—the use of satellites.



# Non-Destructive Testing

A Conference on Non-Destructive Testing in Electrical Engineering was held at the Institution of Electrical Engineers in London from 8th to 10th November. Forty-six papers were presented at the seven technical sessions, and the discussions were most lively. This article presents a brief survey of the papers and a report on what was said during the discussion periods

## BY A SPECIAL CORRESPONDENT

AT the opening session of the recent I.E.E. Conference on Non-Destructive Testing the President, Mr. G. S. C. Lucas, indicated that more than 400 people had registered for the conference, including 16 overseas visitors. In introducing Dr. R. W. Sillars, who gave the opening address, Mr. Lucas stressed the importance of non-destructive testing techniques in relation to the larger and more expensive units in present-day construction.

Dr. Sillars referred to the various non-destructive testing (n.d.t.) techniques which were available to the engineer today. The n.d.t. of components was undertaken primarily to ensure that systems which had been found to be satisfactory were successfully reproduced in current production. He analysed several general types of tests, among which were those dependent on electrical, magnetic and chemical measurements. Among the chemical methods available to the experienced engineer was his sense of smell, which enabled him to detect degradation products of ageing in equipment. The need to correlate n.d.t. with service life was a vital one in which many difficulties existed. Reviewing the various mechanisms of breakdown, Dr. Sillars stressed the important role of moisture content in insulation. Proof tests on apparatus for the purpose of detecting gross manufacturing defects were essential but every effort should be made to ensure that such tests were truly non-destructive. It was doubtful whether X-ray examination could be used effectively in routine tests since the technique was incapable of detecting inhomogeneities less than one per cent of the total thickness being tested.

### Moisture in Insulation

At the second session of the conference a group of papers dealing with the properties of materials was covered. The two papers by T. S. McLeod and A. E. Yallop and by A. W. Stannett, dealt with the presence of moisture in insulation under the titles "The Electrical Determination of Moisture in Paper" and "The Detection of Incipient Breakdown of Oil-Immersed Bakelised Paper Contaminated by Water." The former paper dealt *inter alia* with a method of determining the moisture content of paper as it is made, by making use of the change in the permittivity of paper with different moisture contents. The "fringing capacitor" technique requires electrodes only on one side of the paper so that it is suitable for production runs. The values of capacitance changes are small so that sensitive detection equipment is required. Mr. Stannett's paper was concerned with the possibility of thermal instability arising from the absorption of water in a surface layer of oil-immersed paper. The hazard may

be detected by changes in insulation resistance and he suggested rejection limits for certain factors of safety.

In the discussion, Mr. Dixon pointed out the difficulties associated with the determination of zero moisture content, since, somewhat paradoxically, the effect of drying cellulose was to produce more water as a degradation product. This point was also made by Mr. Norris, who stressed the need for caution in extrapolating from tests on some types of paper to include the large numbers of electrical papers in use today. Mr. McLeod commented that in his work zero moisture content had been assumed when specimens which had been maintained just above 100°C for some time were found to have attained a constant weight. Mr. C. G. Garton, in a contribution from the chair, indicated that the determination of zero moisture content in cellulose specimens was achievable, although the problem was more difficult in made-up apparatus. He described the mechanism of water production in heated cellulose dependent on the association of hydroxol groups within the structure.

### Corona Method of Testing Enamelled Wire

A paper by K. W. Ffitch and P. Graneau dealt with "Non-Destructive Testing of Enamelled Wire by a Corona Method." It was claimed that the sensitivity of this method, which depended on the occurrence of corona when a pinhole in enamelled wire found itself inside a concentric cylinder at high voltage, could be adjusted to correspond with the sensitivity of the mercury bath test. In reply to a question by Mr. Fox it was stated that calibration of the corona method made use of the mercury bath system. Mr. Graneau added, however, that in addition to the permanent damage done to the enamel in the mercury bath test, reproducibility between two mercury baths, in series with one another, was not greater than 80 per cent. Mr. Fox disagreed with this viewpoint and stated that agreement between separate mercury bath tests was 100 per cent in his experience. He also indicated that if greater sensitivity of pinhole detection was required, other immersants could be used in place of mercury. Copper sulphate solution, for instance, was twice as searching as mercury as a bath medium.

### Transformer Oil

"Non-Destructive High-Voltage Impulse Testing of Transformer Oil," by W. P. Baker and P. Reece, described a new method of minimising the energy dissipated in the oil on breakdown so that successive tests may be made on the same sample. This is achieved by arranging the test specimen in series with a capacitance of approximately



equal value. When the oil sample breaks down the charge transfer is limited to that necessary to charge the series capacitor to the output voltage of the impulse generator. The authors claimed a need for this device since trigatron devices were not sufficiently quick acting to protect the sample, but Mr. K. H. Stark questioned this. Mr. Baker replied that while chopping times of the order of a microsecond could be achieved by trigatron devices when breakdown occurred on the peak of the impulse, delays of tens of microseconds might occur when breakdown occurred on the wavefront.

Other papers in this session dealt with the detection of ionic impurities in insulation (Z. Krasuchi and H. F. Church); measurement of surface resistivity (E. C. Salt-house and D. S. McIlhagger); comprehensive range of tests on S.R.B.P. laminate (F. C. Walmsley); means for simulating the effects of defective contacts on insulation (C. A. H. Thornton); tests on surface hardness of steels (J. A. Betts and J. P. Newsome); and properties of soft magnetic materials (A. C. Lynch and G. N. Eastwood). Nucleonic and capacitive methods of thickness measurement in film and fibres were discussed in papers by P. W. Boyle and by C. D. Rutter *et al.*, respectively.

### Tests on Stators

The session on components contained three papers directly relating to tests on turbo-alternator stators by J. L. Douglas; J. S. Simons and M. T. Richards; and K. H. Stark. The group presented a graded viewpoint, from Douglas's conclusion that no discharge test or any other known non-destructive test could detect deterioration due to discharges in the main stator insulation, to Stark's claim to be able to determine the effective age of a stator to within three years by a composite test technique. Mr. Douglas maintained the point of view he had set out in his paper by referring to tests carried out on new stator bars, including those into which faults had been introduced deliberately. Apart from an increase in the number of small discharges, there were no other appreciable differences in electrical properties. Stark observed that the scatter in observations on new machines was reduced after machines had been in service for a few years. He thought this was probably due to post-curing of the binding resins used in conjunction with mica flake. In response to a question raised by the rapporteur, it was pointed out that the five tests used in arriving at the "figure of merit" in Stark's paper, had been chosen since commercial apparatus already existed to implement the tests.

J. H. Mason's paper on "Over-Voltage Tests on Insulation" stressed the possible damage which could be caused to insulation during the one-minute withstand test at multiples of the rated voltage. He suggested replacing this test with one of lower frequency or in some cases with a single impulse test. However, E. L. White, in his paper on "Impulse Voltage Acceptance Tests," had noted the lack of repeatability in successive impulse tests on machines. Dr. G. Mole put forward a novel form of over-voltage test in which a damped 50 c/s wave train was suggested. This had the effect of exposing the insulation under test to the peak voltage for only one cycle. He described a simple circuit which could be used for such tests. A. W. Stannett, who had already stressed the importance of water in bakelised paper in an earlier paper, returned to this theme in "The Measurement of

Water in Power Transformers." His results showed the insensitivity of electrical measurements made at the terminals of transformers as a means of estimating water content in the winding insulation. This insensitivity, largely due to the existence of dilution factors in parallel at the terminals, could be overcome by the use of a probe technique. Thus a piece of paper with evaporated-on electrodes, inserted in the oil of the transformer as near as possible to the winding, acted as an effective sampling probe. By measuring changes in insulation resistance in the probe, reliable estimates of water content could be made. G. Mole thought the probe technique to be a very useful approach, but suggested some caution since the probe would come to saturation quicker than the bulk of the transformer insulation—a point which Stannett indicated to have some advantages, in the sense that it gave early warning. Dr. Mole, drawing on the point he had already made and because of the need to have both probe and transformer insulation at the same temperature, suggested that it may be possible to embed the probe in part of the winding. Mr. Cameron's paper on "The Evaluation of Insulation Systems to Determine Life in Service" covered a wide range of testing techniques. Non-destructive tests in this field were traced from those on the basic materials through tests on models to provide functional data, leading ultimately to tests on prototype apparatus.

### Discharges in Cables

J. A. Nawiesniak and his colleagues dealt with techniques which can be used on the production line for "Electromagnetic Inspection of Non-Ferrous Wires and Helically-Wound Heater Elements." An active discussion was centred around the group of papers by J. D. Endacott and E. L. Smith; R. C. Mildner; and F. H. Kreuger in the session devoted to cables. The three papers took as their general theme the problem of detecting electrical discharges in extruded cables. The basis method used by the authors for locating discharges in unscreened plastic cable is to pass the cable through a hollow cylinder maintained at high voltage while immersed in an insulating or semiconducting medium. In this way, only the short length of cable inside the cylinder is highly stressed so that discharges can occur only in this part of the cable. Thus localisation of faults is readily achieved. The method of discharge detection which seems most promising is that based on the design of Dr. Mole, of the E.R.A. Using this equipment, Endacott and Smith have developed a system in which the maximum test voltage is at present 100 kV. The discussion on the papers revealed a difference in outlook as to the possibility of developing plastic-insulated high-voltage cables to the extent where they could be operated at stresses comparable with those for oil-impregnated paper. While Endacott was optimistic that development already in hand would achieve substantially cavity-free extrusions for high-voltage cables, Mildner thought such a development unlikely in the foreseeable future. Mildner based his view on the inherent difficulties associated with the water cooling of extruded layers which could lead to cavity formation and to a type of fissure-like fault he had noted recently which was not detectable by the usual techniques, but, nevertheless, led to breakdown. Several contributors discussed points in the refinement of detection circuits and others



suggested the need for automating the detecting apparatus. Endacott thought that it was not advisable to draw up specifications for discharge detection at the moment. Other topics covered by papers in this session were the detection of leaks and serving defects (H. T. Gooding and T. A. Bricant); methods for monitoring cable dimensions during manufacture (A. C. Lynch and E. A. Speight and also W. L. Town). The remaining papers dealt with s.c.a. conductors; the testing of compression fittings (V. T. Morgan and D. W. Vaughan) and the detection of electrolytic corrosion (D. W. Vaughan).

## Radiography

Of the six papers presented at the session devoted to the detection of concealed internal features in components, four dealt with radiographic techniques. "Xero-radiography Applied to the Inspection of Electrical Equipment" was the subject of a paper by A. Nement, A. W. Balls and W. F. Cox. This put forward the advantages of xerography as an alternative to X-ray film as the recording medium during radiography. The xerographic process relies on the ability of selenium to lose surface charge when exposed to X-rays. Thus a plate which is charged beforehand, loses charge selectively in relation to the image intensity focused on its surface. The remaining charge pattern may be "developed" by spraying the selenium plate with a fine powder which adheres by electrostatic attraction to the charged regions. Using this process, a "print" may be obtained in about one minute. If a permanent record is required, conventional photography can be employed, the selenium plate being used again after removing the dust image. Flaws and section changes are contrasted selectively by the xeroradiographic process and is thus, in some cases, an advantage over conventional radiography. L. W. D. Pittendrigh's "A Stroboscopic X-ray System" was the analogue of the well-known optical technique. Since electrical devices are found to fail in service as a result of vibration, it is essential to test completed apparatus so that the mode of vibration was relevant to service application. This frequently means that the device is obscured by protective covering making the use of X-rays necessary to observe stationary patterns.

The use of X-radiography for the detection of flaws in components was the subject of two papers by R. Taylor and D. C. Shotton. The former examined resistors, fuses, capacitors, terminal seals, and valves to ensure high reliability for submarine cable repeaters, while the latter's subject was the joint in the submarine cable itself.

The papers by R. O. Jenkins, and P. F. Berry and J. F. Cameron described techniques for detecting gas leaks in components. Apart from measuring changes of pressure with time, R. O. Jenkins described more specific methods using gases which were readily detectable by suitable techniques. Of these the halogen detector, hydrogen diffusion detector and mass spectrometer offered most advantage. The mass spectrometer used in conjunction with helium gas was particularly useful for detecting small leaks. However, the authors of the second paper in this group claimed that their technique had a sensitivity equal to the helium mass spectrometer, while the cost of their apparatus was very much less. Their apparatus was a scintillation counter used to detect

radioactive krypton issuing from components which had either been prefilled with the gas or had allowed the gas to leak into them under differential pressure.

A short session on "Contacts and Joints" contained two papers on each topic. The papers by J. Pullen and by A. Fairweather *et al.*, dealt mainly with the problems involved in the measurement of contact resistance. Pullen is concerned with the factors to be taken into account if accurate measurements of contact resistance are to be made. The second paper describes a method for making the measurements automatically, a necessary development to cope with the large number of tests to be carried out in evaluating contact materials, as pointed out by F. Lazenby, a co-author, in the discussion. Mr. Miller thought that automatic testing still left the time-consuming problem of analysis of the results unsolved; he also thought that the length of "wipe" was a parameter worthy of investigation. In reply to further questions Mr. Pullen stressed the need for care in measuring the very low values of contact resistance. Test voltages as low as 100 mV could change the contact resistance of their surface films and he recommended test voltages less than 50 mV to obviate an over-optimistic estimate of the state of a contact. In his paper Mr. Pullen had recommended test voltages as low as 10 mV for low-voltage contacts. The paper by A. C. Delamere and Weeks on the "Testing of Solderless Wrapped Connections" discussed the various mechanical binding techniques used in the electronic industry for making reliable contact between two or more wires. There are two ways of securing a wire to a contact: (1) a wrapped joint, in which the wire is coiled around the contact; (2) a bound joint, in which the binder is an independent wire bound around wire and contact placed side by side.

The n.d.t. of electrical joints was the subject of J. B. P. Williamson's paper in which he covered the many electrical and mechanical criteria to be satisfied by an acceptable permanent mechanical joint. In his paper, and in the discussion, he referred to the difficulty in extrapolating from short-time laboratory tests to expected service life. Mr. McDonald stated that joints in power cables were required to transmit considerable mechanical forces as well as having the necessary current-carrying characteristics. Mr. Raymond, who referred to the use of a Kelvin bridge in measuring the resistance of joints, stated that a life of 20 years required from some apparatus would be inadequate for cable joints. He thought an expected life of 80 years to be a requirement in considering joints of similar age existing in the London area today.

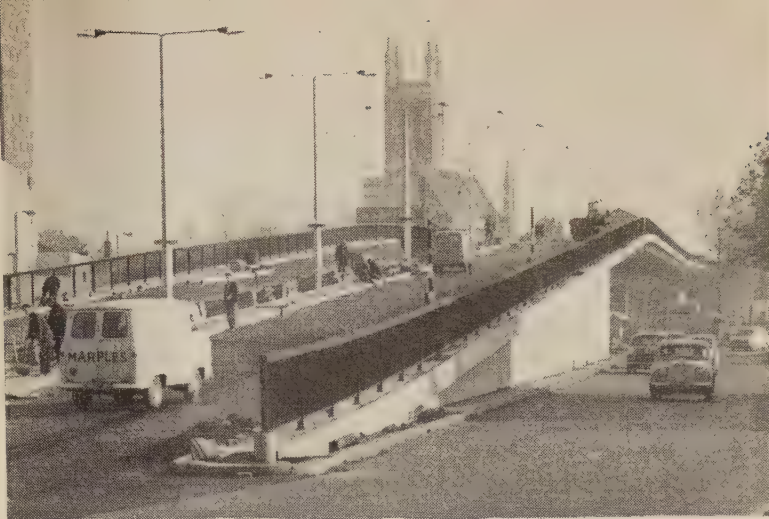
## Vibration Effects

The final session of the conference was devoted to a consideration of four papers dealing with the effects of vibration in service equipment. Again the number of papers were equally weighed to embrace laboratory techniques and field observations. In the former class there were the papers by P. B. Barber and J. S. T. Looms which dealt with the detection of movements of the order of  $10^{-5}$  cm using a microwave probe, and the paper by Mr. Brownsey dealing with the characteristics of anti-vibration materials. The papers by V. T. Morgan and T. R. Warren and G. S. Wilton, dealt with the problem of fatigue in conductors owing to wind-induced movements of the line.



# HAMMERSMITH FLYOVER

## Large Road Heating Installation



**C**ONSTRUCTED at a cost of approximately £1½ million, the new flyover at Hammersmith, London, was officially opened to traffic on 16th November by the chairman of the London County Council, Mr. Harold Shearman, M.A., J.P. With a total length of 2,831ft, including the approaches, the new road provides dual carriageways, each 24ft wide, and will serve as an essential link for through traffic between central London and London Airport and the west. The use of pre-stressed concrete has enabled the flyover to be designed as a slim superstructure supported by 15 single tapering columns, the length of each span being 140ft.

The flyover is believed to be the first of its kind to be completely heated throughout its entire length to prevent the formation of frost and ice. It is certainly London's first major electrically-heated road surface. The whole installation is completely automatic in operation and is designed to switch on when the temperature falls below 37°F, when the road is wet. To cater adequately for all weather conditions, it was necessary to install moisture detectors, thermocouples for road surface temperature measurement, and snow and frost detectors.

The project involved the use of 572 "Panelec" heating cable units supplied by British Insulated Callender's Cables, Ltd., totalling approximately 66 miles in length. The heating cables proper have a total length of over 60 miles and there are more than five miles of cold tails.



General view of the Hammersmith flyover during construction with the electric heating cables being installed in the foreground

The total weight of cable involved is approximately five tons and the area heated is 14,955 sq yd.

Each cable consists of a single-core element, comprising seven strands of resistance wire insulated with butyl rubber and sheathed with a nitrile butadiene rubber compound. The heating load per square foot is 10.4 W on the embankments, 12.5 W on the inner lanes and 13.2 W on the outer lanes.

The heating cables were laid across the roadway between temporary jigs on which discs were fitted to ensure correct cable spacing. The spacing between heating cables is 5.7in on the embankments, 4.8in on the inner lanes and 4.5in on the outer lanes. The cables were then covered by ½in of sand asphalt, hand laid and compacted by a light roller. The jigs were then removed each side and the exposed cable loops covered in a similar manner, thus leaving the cables free to move with any creepage which may occur. The wearing asphalt carpet was laid by machine and each cable was under continuous test by monitoring equipment.

The London Electricity Board has provided three services, each suitable for a maximum load of 575 kW. Two services are in a control chamber within the eastern abutment and one is in a control chamber within the western abutment.

The electrical contractors who carried out the road heating, and the installation of the p.i.l.c. and armoured cable from the substation at each end of the flyover to the various fuse distribution boxes, were the Alliance Electrical Co., Ltd. This company was also responsible for the design of the heating cable laying jigs.

The lighting of the flyover is also of interest. The installation consists of twenty-eight 25ft concrete A.E.I. "Trifoil" columns at approximately 100ft intervals along the centre reservation. Each column is equipped with two Atlas "Alpha Three" lanterns fitted with mercury fluorescent lamps. The siting of the columns along the centre reservation rather than along the kerbs was decided upon mainly for architectural reasons.

In addition, some 56 specially designed lanterns are fixed to the underside of the flyover to provide adequate lighting over those areas where normal street lighting columns cannot be fixed.

The lighting columns were erected by the main contractors for the flyover (Marple, Ridgway & Partners); the London Electricity Board installed the cabling in the road; and the Alliance Electrical Co. were also responsible for the wiring in the columns and lighting on the underside of the flyover.



# VIEWS on the NEWS

By "REFLECTOR"

**L**IGHT is always an attraction, equally to moths and men, and so a film displaying many of its manifestations is almost certain to be a success. Thus, I think, the Rank Organisation could hardly be wrong in including "Lights Up!" in its "Look at Life" series which form a regular feature in its cinema programmes. This ten-minute film, in very good colour, consists of a number of shots on the lighting theme which although of considerable variety are made to form a coherent whole. Beginning and ending with views of the Lizard Lighthouse (Cornwall) in operation, the scenes include such familiar sights as Piccadilly Circus and the Blackpool illuminations, and bring in quite effectively a bit of office lighting (the offices are those of the British Lighting Council in which Messrs. A. Wilcock and W. Robinson (E.D.A.) are seen conferring) and shots of lamp production and testing (by courtesy of the G.E.C.). In the course of the proceedings a little easily-digested technical instruction is given. The film should be appreciated by the public and make them look to their lighting.

\* \* \*

The use of the mouth-to-mouth or mouth-to-nose method of resuscitation from electric shock, as an alternative to the Holger Nielsen system, is being actively canvassed. Another possible alternative was put forward in a paper by Mr. J. Bekink (Netherlands) presented at the recent UNIPED Congress. This consisted in the application of a further electric shock to the victim. It is claimed that this ends fibrillation by sudden and simultaneous contraction of the heart muscles and sudden relaxation. A current at 50 c/s of about 5 A applied for 0.10 second had been found to be effective. This had been done successfully in operating theatres, the author said, but as it involves treatment within three minutes and close control of the shock current I do not see how the method could possibly be used outside the operating theatre or laboratory.

\* \* \*

Referring to a note of mine in the *Electrical Review* of 22nd September, a correspondent in Pakistan has sent me cuttings from the *Morning News* (Karachi) reporting the speech of the chairman of the Karachi Electric Supply Corporation (Mr. M. R. Zaman) at that body's annual general meeting. Mr. Zaman mentioned that consumers' arrears had amounted to Rs. 143.8 lakhs (something like a million pounds sterling) and the company were taking steps to recover their dues which were making them unpopular. If no headway were made, he said, the company would "be forced to take the unpleasant step of stopping supplies in the case of defaulters." Later he

stated that there had been "dissatisfaction over the delay in the issue of, and mistakes in, our bills" and he admitted that there was still reason for this dissatisfaction. Among the responsible factors he included "teething troubles" in the mechanisation of the billing process. All of which goes to show that it's the same the whole world over.

\* \* \*

"Which?", the Consumers' Association publication, turns its attention to electric socks in its November issue. These are not foot-heating hosiery but are claimed by the makers to relieve rheumatism and arthritis. The "operative" components of these socks (which are actually insoles for shoes) are reminiscent of the "electric belts" which once had a vogue and were the subject of severe criticism in the *Electrical Review*. The socks are of felt, cork and cotton; one of each pair contains a strip of zinc and the other a copper strip. It is claimed that

"electricity is produced by the metal elements in the socks which enters the body through the pores of the feet and reaches the entire bone structure of the body."

"Which?" says that tests failed to reveal any changes in the electrical activity of the bodies of two "patients," who said that there had been an improvement in their condition through wearing the socks. Actually, five out of 25 "guinea pigs" reported improvement, even when the metal strips were removed; three showed deterioration in condition; and the remaining 17 showed no detectable change. The main conclusion, with which I agree, is that a sufferer from rheumatic ailments should consult his own doctor, who will, if necessary, obtain for him (non-electrical) socks through the National Health Service.

\* \* \*

For some reason, at the turn of the century, French physicists were anxious to arrive at the electrostatic capacity of the human body. After a reference to experiments by Bordier and Dubois, the *Electrical Review* of 22nd November, 1901, dealt with tests conducted by G. de Metz and stated:—

"In de Metz's tests the naked body was thoroughly insulated and placed in the centre of a large room, in order to neutralise the disturbing effect of surrounding conductors. Under these circumstances he found the capacity of the human body to be much less than that obtained by his predecessors, namely, 0.00011 microfarad, or 100 cm in absolute electrostatic units. The electrostatic capacity of a man can be readily remembered as being equal to that of a metal sphere, 2 metres in diameter. The charge which a man receives with a pressure of 1,000 volts is  $11 \times 10^{-8}$  coulombs."



# Terminal Box Design

By K. K. SCHWARZ, M.A., A.M.I.E.E.

Author's summary of a paper entitled "The Design and Performance of High and Low Tension Terminal Boxes" which was read at a meeting of the Institution of Electrical Engineers on 16th November

**W**HILST the problem of faults in termination equipment, both air and compound insulated, is by no means new, the effects and dangerous consequences, e.g. explosions, are dependent on the short-circuit fault power level of the system. An investigation into the causes of faults leads to a number of conclusions regarding the dielectric design of air-insulated termination arrangements, whilst a clearer understanding of the effects of an electric arc in a small enclosure results in additional design requirements.

Fig. 1 shows a current 3.3 kV motor terminal box incorporating the necessary features, first, to achieve the greatest dielectric safety, i.e. prevention of the occurrence of a fault, and second, to ensure the minimum external danger should a fault occur.

The basic requirement for good dielectric performance is a clean, dry enclosure, and therefore the fabricated steel terminal box is fully gasketed and fitted with a desiccator, acting as a dryness indicator as well as a means of moisture removal. The motor leads are sealed by the normal machine impregnation process into the back of the box to prevent any ingress of moisture or dirt from the motor.

The terminations themselves are in the form of a permanent connector, to which are bolted both the motor and incoming cables, and the connections are finally covered with self-adhesive silicone tape or equivalent, so that no bare metal at potential is exposed. It is important to note that for testing purposes the incoming cable, and therefore the compound, remains undisturbed. The whole assembly is extremely rigid mechanically, and with appropriately designed cable sizes and joints, which are preferably crimped, the complete equipment is made through-fault-proof for the specified fault current.

Regarding design features required to minimise the danger from an actual fault, investigations show that the pressure developed by an arc in an enclosure varies (a) inversely with the volume and (b) proportionally with the arc energy, i.e. the arc current

times the arc voltage (the latter effectively dictated by the electrode separation). The pressure rise is substantially exponential with a time constant of 30 millisecc under normal air conditions, i.e. much longer than the normal (say 0.25 sec) circuit-breaker clearance times. For example, in the terminal box of Fig. 1, the prospective pressure rise is 1,200 p.s.i. on a 3.3 kV supply with 250 MVA short-circuit capacity. This is clearly an impracticable operating condition for an enclosure, and so a pressure relief vent is provided, which takes the form of a diaphragm or equivalent arrangement. This limits the maximum pressure rise to 100-150 p.s.i., the steel terminal box being designed to withstand at least 200 p.s.i. It is important to relate the size of the vent to the actual fault conditions, in order to obtain the minimum safe exhaust of flame and gas. A further hazard occurs during faults due to the possibility of flame cutting by the arc, and this difficulty is overcome by a barrier, fitted when necessary, as indicated in Fig. 1.

Extensive investigations at fault conditions up to 250 MVA at 3.3 kV, and comparisons with conventional terminal arrangements, showed that the fault behaviour

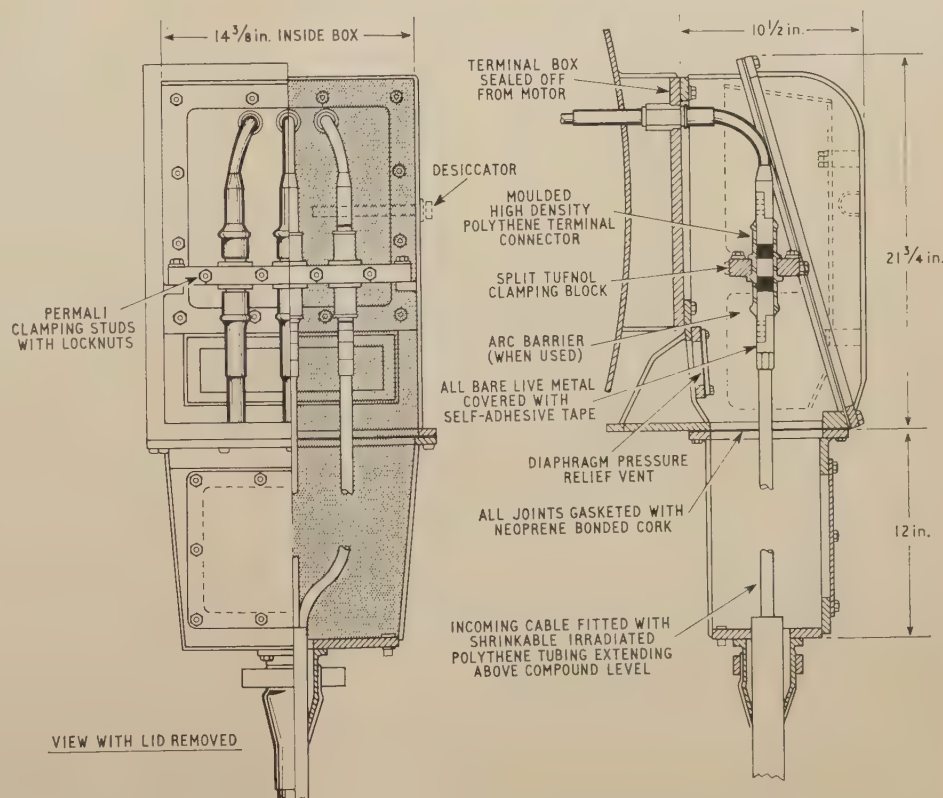


Fig. 1.—Sealed terminal box with cable connectors and diaphragm pressure relief vent



of the terminal box design of Fig. 1 with connectors, leads to a minimum affected area near the equipment, and this may be further localised by the use of an arc chute acting as a cooler for the exhausted flame.

The clearances and creepages are made to B.S. 159, assuming bare terminations, thus obtaining another safety margin, as all bare connections are taped and, moreover, the taping will not support an arc, as demonstrated during the short-circuit tests. Thus, for 6.6 and 11 kV, with up to 500 and 750 MVA respectively, similar terminal boxes with wider connector spacings are used.

Another way of solving the pressure rise problem is the use of an electrical limiter instead of the mechanical limiter, i.e. pressure relief vent. Fuses will achieve this very satisfactorily, but they are not normally used for high-voltage motors in this country. For low-voltage applications with high fault levels, however, where the pressure rise problem is similar to that of high-voltage equipments, fuses are normally fitted, so that an unvented steel terminal box designed on similar principles to Fig. 1, but with normal stud type terminals, behaves satisfactorily. This is proved by tests at 440 V, 35 MVA, with h.r.c. fuse sizes up to 750 A. These tests give good agreement with the calculated performance and confirm, moreover, that for h.r.c. fuse sizes below 100-200 A, no difficulties should be experienced with conventional terminal boxes.

To summarise, the information presented in the paper covers the detailed design of an air-insulated terminal box, having maximum dielectric and fault condition safety.

## DISCUSSION

The discussion on the paper on which the above article was based was opened by Mr. L. W. James (C.E.G.B.). He said that for more than thirty years the terminal boxes of h.v. motors seemed to have given satisfactory service and the first indication of trouble received by the Board had been in 1957. The reporting of faults was automatic only when a particular design defect was noted or at least 30 MW of main generator plant was shut down. A detailed investigation showed that similar troubles had occurred elsewhere and that in the five years up to January, 1958, 74 failures of motor terminal boxes had occurred, half of which resulted in explosions and shattered boxes. From that date to November, 1960, 30 boxes failed, again about half resulting in explosions. A statistical survey showed no connection between the characteristics of the system and the particular failures, but examination of a number of boxes showed that the clearances inside and cleanliness after operation for short periods left much to be desired. Co-operation between motor makers and the C.E.G.B. had initiated the production of a standard 3 kV terminal box incorporating the lessons learned and this would be available to all motor makers.

Mr. D. D. Stephen (A.E.I.) said that there seemed to be no clear understanding of why some boxes blew up and others did not. Even if all the features suggested by the author were incorporated the cable crutch would still exist and there would be a weakness there. The use of butyl rubber for cables, which simplified sealing, might help.

Mr. T. B. Rolls believed that for flameproof equipment the first way of overcoming the difficulty would be to have complete phase separation within the motor terminal box and earth the system neutral through a resistance, so that the prospective fault current was kept to a small value. For non-flameproof conditions it might be necessary to think again of using contactors rather than circuit-breakers for h.v. motors, backed up by cartridge fuses.

Mr. P. Huggins (L.D.C.) described the terminal box design selected by the C.E.G.B. and B.E.A.M.A. as the prospective standard for h.v. motors for the Board's generating stations. Fourteen prototype 3.3 kV boxes of this design were being made for proving tests, including through short-circuits and internal short-circuits, at the highest fault level envisaged for this voltage, 250 MVA. If they passed the tests, standard boxes on the same lines would be developed for 6.6 kV and 11 kV, for which the highest fault levels were 500 and 750 MVA respectively.

The terminal assembly comprised cadmium-copper terminal studs of liberal cross-section in a cast epoxy base. After making the line connections the terminals and ends of the cable tails were finally insulated and sealed by Neoprene rubber caps and supplementary cable seals. The minimum sparking distance between terminals and to earth was 2 in, as required by the C.E.G.B., but the creepage distances were over double the minimum specified by the Board.

Mr. T. H. Mason (C.E.G.B.), referring to the possibility of voltage surges triggering off terminal box flashovers, said that measurements to determine the order of the over-voltages produced showed that the peak voltage compared with the phase peak voltage might be as high as 5 times with oil-break gear and 1.7 times with air-break gear. At one station where repeated breakdowns had occurred, to reduce overvoltages a capacitor-resistor damping circuit had been devised and repeated tests showed that the surge voltage was halved. Since then no breakdowns of motor terminal boxes had occurred there.

Mr. C. W. Dawson suggested that with the normal type of cable box in which the cable tails and terminals were immersed in solid-setting compound the problems would not arise. The cable tails would be rigidly supported throughout their length and any arcing would be severely restricted in its early stages, so that the circuit-breaker would have time to detect the fault and open. It was the facility required by users of being able to disconnect the motor without breaking down the cable box which had brought about the hazards. To provide a box which could be blown up safely pressure-release diaphragms had been fitted, but he regarded this as a retrograde step and would prefer a box in which the three phases were physically separated and the fault current limited to a safe level by fitting a neutral earthing resistance.

Mr. W. Fordham Cooper pointed out that although there had been so much excitement due to the discovery that motor terminal boxes would blow up, a steady stream of cable boxes on transformers and switchgear had been blowing up over the years and it was time some experimental work was done on them. Bad workmanship was often the cause. In the new design of motor terminal box nothing had been done about the crutch of the cable (which in other cable boxes was what most often broke down) or voids in the compound. Some research should be done on how to find out when a box was going to break down.

Mr. J. Tozer complained that it was impossible to get a 115 V motor below 25 h.p. with a decent terminal box. The terminal box should be to B.S. 542, which stipulated phase-to-phase and phase-to-earth clearances of  $\frac{1}{2}$  in, but the makers' standard was to B.S. 587, which referred not to motors but to starters and controllers, and provided clearances of only  $\frac{1}{4}$  in.

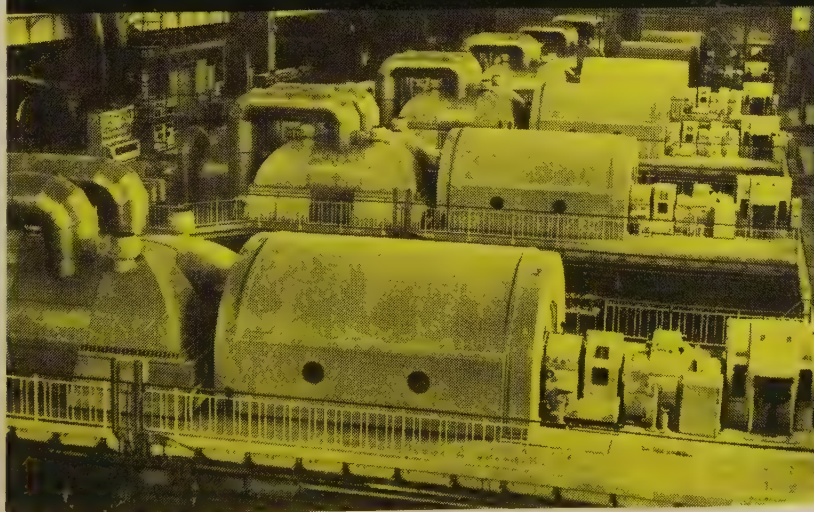
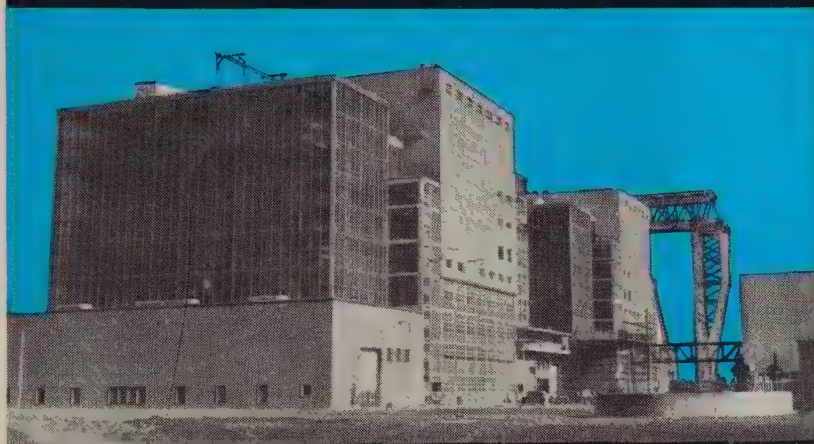
Mr. W. E. G. Robinson advocated a solid cable box, solidly compounded up, pointing out that with h.v. motors there was usually a duplicate machine standing by. He contended that a major cause of sloppy cable jointing was late delivery of gear by the motor manufacturers, which caused pressure to be put on the cable jointers to get the job finished on time.



# ELECTRICAL INSULATION

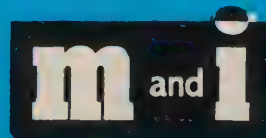


## for Nuclear Power Stations



The first two C.E.G.B. Nuclear Power Stations both make extensive use of M&I insulation; in the electrical plant supplied by A E I to Berkeley and by C. A. Parsons & Co. Ltd., to Bradwell. Amongst the various types of insulation supplied are "Paxolin" tubes, transformer cylinders and fabric based material as well as Micanite in various forms including V-rings.

As the manufacturers of the most extensive range of electrical insulating materials in this country M & I naturally have a wide experience of insulation problems on every type of power generation and distribution system.



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**THE MICANITE & INSULATORS CO., LTD.,**  
Walthamstow, London, E.17.

Tel: Larkswood 5500.

Grams: Mytilite, London, Telex. Telex 25183

Photographs by courtesy of The Nuclear Power Group.  
Bottom picture shows the six Parsons 52MW turbo-generators in which M & I Micanite V-rings have been used.





## SPOTLIGHT ON A GOOD INSTALLATION

The school installation must provide safe, reliable and continuous service. At the same time, the wiring accessories—those parts of the installation which could be handled by the children—must be robust and tamperproof. For these reasons, Crabtree circuit breakers are being increasingly specified for the protective

In this type of Crabtree switched socket-outlet the metal plate is fixed directly to the box by four corner screws. It is also available with or without locking ring or pilot light.



In this type of Crabtree switch assembly the metal plate is fastened by two screws to each switch, the screw heads being covered by a large ring locked by means of a keytool.



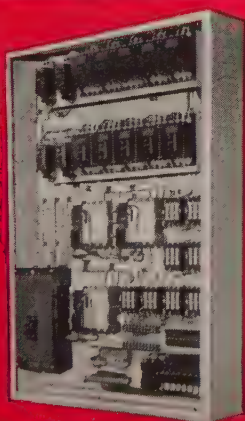




control of main and sub-circuits and Crabtree metal-plate assemblies with locking rings for all lighting and socket-outlet points. To install Crabtree throughout a school is automatically to ensure that the "moving parts of the installation" will last as long as the building itself.

## CRABTREE

J. A. CRABTREE & CO. LTD., LINCOLN WORKS, WALSALL, STAFFS.

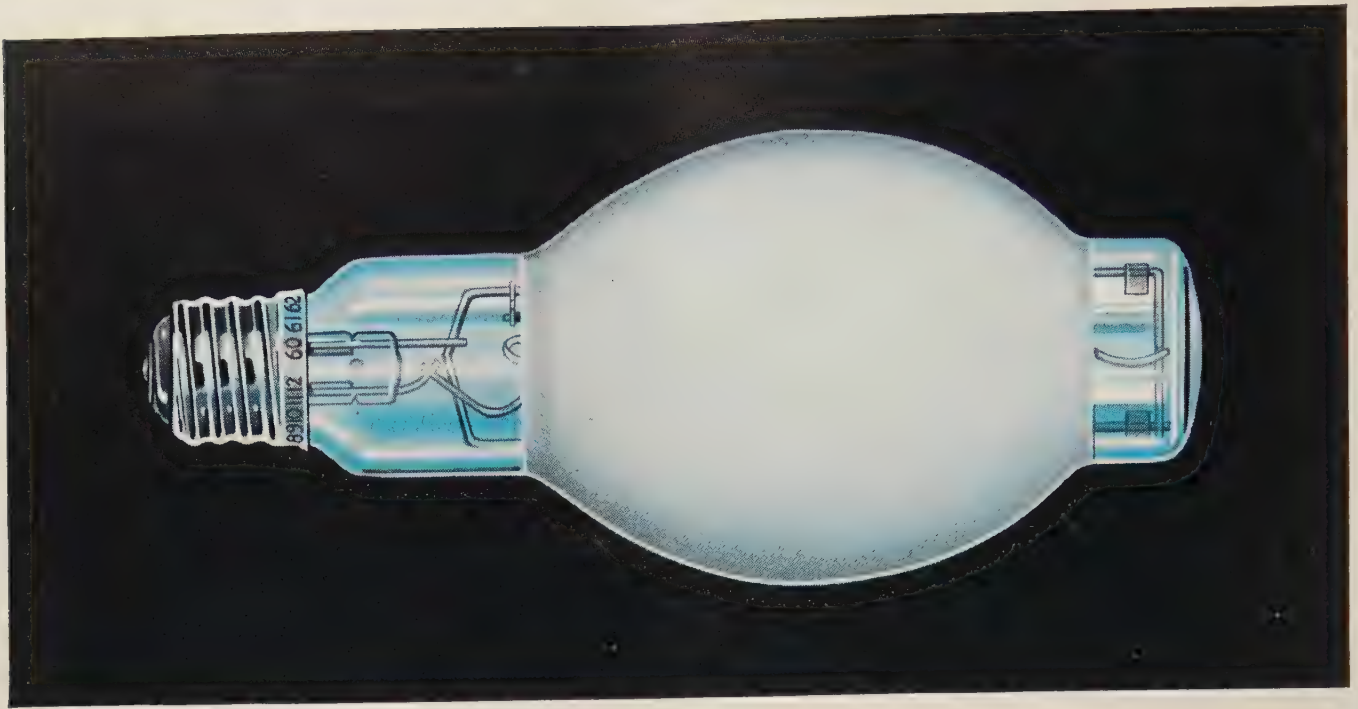


This is a typical Crabtree control unit embodying double and triple pole circuit breakers, triple pole contactors and auxiliary equipment providing fully automatic protective control of floor heating throughout the school.



This neat flush distribution board embodies 36 Crabtree Type C-50 circuit breakers in protective control of all school lighting circuits. Crabtree circuit breakers give close overload protection and thus reduce fire risk, give immediate fault indication and enable rapid restoration of supply to be achieved without the inconvenience of fuse replacement.





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# ELECTRICITY SUPPLY PROBLEMS

Summary of the 1961 Mitchell Memorial Lecture delivered by Sir Christopher Hinton, K.B.E., F.R.S., at the Victoria Hall, Hanley, on 15th November. The Reginald Mitchell Memorial Gold Medal, which the Stoke-on-Trent Association of Engineers awards annually to a distinguished engineer, was presented to Sir Christopher. R. J. Mitchell was the designer of the Spitfire aircraft and was a student founder member of the Association

THE downward trend in the real cost of electricity has, for many years, been due to the rise in the initial temperature which it has been possible to achieve in the heat cycle. Since steam turbines came into use, this top temperature has been controlled mainly by the metallurgy of the materials available for superheater, steam pipe and turbine construction. The increase in temperatures has done more than raise the thermodynamic efficiency that can be achieved; it has made it possible to use higher steam pressures and this (operating with other developments) has made it possible to build bigger boiler and turbine units and it is this growth in unit size and rating which, more than anything else, has brought down capital costs. The development pattern in recent years is demonstrated in the table.

In 1948, the Central Electricity Authority was installing boilers which worked at a pressure of 600 p.s.i. and supplied steam to the turbines at a temperature of 850°F; these power stations had an efficiency of 27.5 per cent and they had a capital cost of £67/kW of capacity. Today, we are building boilers which work at a pressure of 2,300 p.s.i. and supply steam at a temperature of 1,050°F

ADVANCE IN COAL-FIRED GENERATING UNITS				
Year of Commissioning	Steam Conditions (Press. Temp. Reheat) p.s.i.g./°F/°F	Design Efficiency %	Size of Set (MW)	Capital Cost (£/kW s.o.)
1948	600/850	27.5	30	67
1950	900/900	30.5	60	57
1956	1500/1050	33.7	100	58
1957	1500/975/950 reheat	34.5	100	59
1958	1500/1000/1000 reheat	35.6	120	53
1959	2350/1050/1000 reheat	37.5	200	50
1962	2300/1050/1050 reheat	37.7	275	41
1963	2300/1050/1050 reheat	38.4	550	37
1964	2300/1050/1050 reheat	38.7	350	39
1965	3500/1100/1050 reheat (Supercritical)	39.8	375	39
1965	2300/1050/1050 reheat	38.7	500	37

to the turbines—a temperature at which steel would show a dull red glow in the dark. To achieve higher efficiencies the steam is returned to the boilers and reheated when it has been partly expanded in the turbines and this, together with the higher initial temperature, gives an efficiency of 38.7 per cent. In spite of the reduced value of money, these plants cost only £37/kW of capacity. The higher steam pressures have made it both possible and desirable to use bigger boiler and turbo-generator sets and while the 1948 turbo-generators had a capacity

of only 30 MW each, those that are now being ordered will generate 500 MW and the generating station that is thought of as the present-day standard has a capacity of 2,000 MW generated in four of these 500 MW sets. Fig. 1 shows (to the same scale) the relative sizes of the turbo-generators as capacity has increased, and the fact that physical size has increased far less than generating capacity shows why the cost per kW of capacity has come down so remarkably.

At pressures and temperatures higher than the 2,300 p.s.i. and 1,050°F which are being used in these present-day sets, it is necessary to use far more expensive materials of construction otherwise failure will occur as a result of “creep,” and the higher cost of these special materials of construction is barely repaid by the increase in efficiency which is achieved. However, to get experience in this advanced field, the Generating Board has ordered two supercritical sets which will operate at 3,500 p.s.i. and an initial temperature of 1,100°F with reheat to 1,050°F. Although the capital cost of these plants is at present rather higher than that of plants working at sub-critical temperatures, there is no doubt that, with the passage of time, the cost of the materials of construction will come

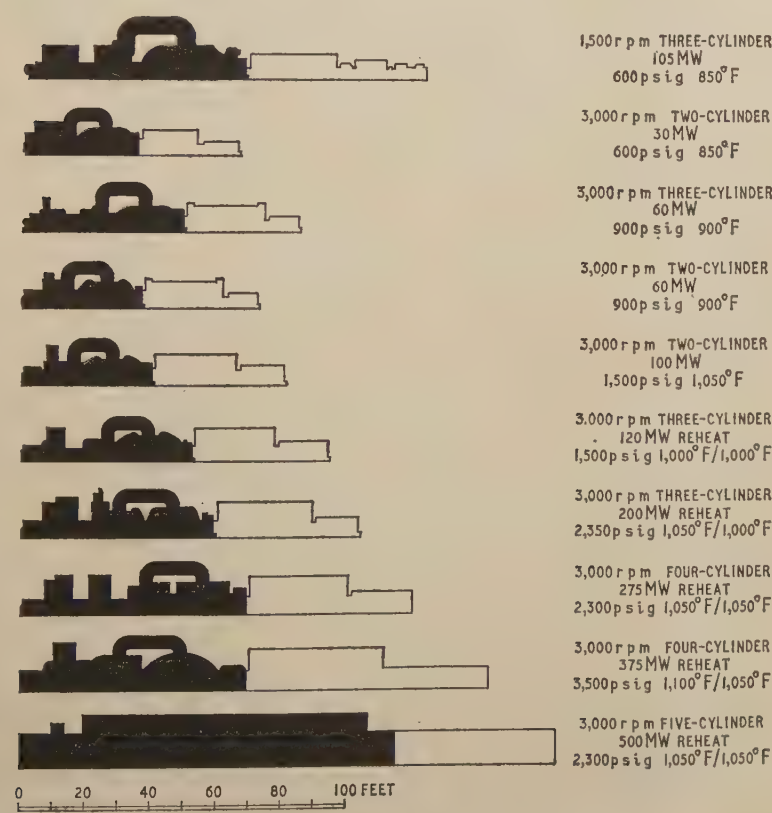


Fig. 1.—Sizes of turbo-generators



down and plants of this type will be used extensively in the future.

If we could today achieve temperatures in the heat cycles of nuclear power plants as high as those that are commonplace in conventional practice, nuclear power could be as cheap as conventional power. That we cannot achieve these temperatures is due to problems within the reactor. [See last week's issue of the *Electrical Review*, a special issue on nuclear power in Britain.] Present reactor practice gives maximum can surface temperatures of 450°C. To achieve higher temperatures it will be necessary to move forward to more advanced reactor systems and it is to move technology its next logical step forward that the U.K. Atomic Energy Authority is building the advanced gas-cooled reactor as a prototype at Windscale, see Fig. 2. [A detailed description of this reactor together with a pull-out coloured illustration was given in our last issue.]

The downward trend in the capital cost of nuclear power plants has been remarkable and continuous; the first industrial nuclear stations at Berkeley and Bradwell ordered in early 1957 will have capital costs of about £165/kW of useful capacity; the latest station ordered for Sizewell will have a capital cost of about £101/kW. This forward trend arises from growing familiarity of the nuclear power industry with the problems of plant design and construction, from better overall optimisation of design and from the ability which these give to design reactors of greater size. While the Berkeley reactors have a capacity of 137.5 MW, the capacity of those at Sizewell is 290 MW. But this rapid rate of growth is not achieved without risk of failure; the only reactors of which there is operating experience are those at Calder Hall and Chapelcross with capacities of 40 MW. It is a rate of extrapolation of experience far greater than is welcome to responsible engineers.

But this rate of technological advance has been necessitated by the effort to bring the cost of nuclear power down

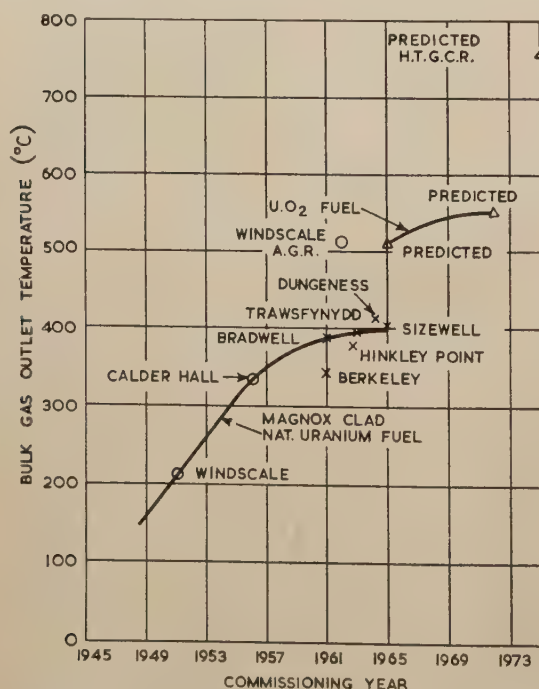


Fig. 2.—The trend of outlet gas temperatures in British industrial reactors

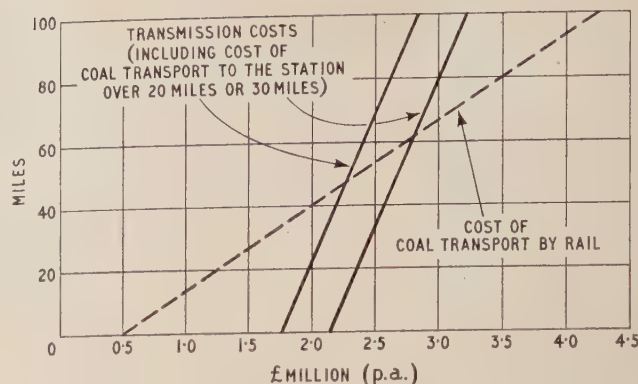


Fig. 3.—Cost of transmission of coal and electricity. This diagram was prepared in 1959 and compares the cost of transmitting electricity at 275 kV from a 1,400 MW 75 per cent load factor station situated on the coalfields with the cost of transport of coal by rail to a similar station situated at the load centre

to that of conventional power in the face of adverse conditions. When the initial nuclear programme was drawn up in 1954, it was calculated that the cost of nuclear power would be about equal to that of conventional power at about 0.6d/kWh. Since then the cost of conventional power has fallen and the cost per kWh produced in the new modern stations is estimated at about 0.5d/kWh, while the cost of electricity from the latest station at Sizewell is estimated at about 0.65d/kWh, an increase which is due to a higher net cost of nuclear fuel than was expected and partly to the fact that long-term Treasury rates of interest have risen from 4 per cent (the rate at which the 1954 calculations were done) to the present rate of over 6 per cent. High interest rates must react against high cost nuclear plant where nearly two-thirds of production cost arises from capital charges.

Yet there can be no doubt of the need for us to have a substantial nuclear programme. When one remembers that the target output of the National Coal Board is 200 million tons a year, it does not appear reasonable to count on more than 100 million tons being available for electricity generation even in the long term. Nor would it seem wise to count on obtaining all of any balance of requirement of fuel by burning oil.

### Transmission

The size of the post-war transmission system was such that 132 kV was no longer a high enough voltage to provide safe interconnection in a national network and, in addition, it was found that by building a new supergrid to operate at 275 kV the base-load requirements of electricity in the South of England could be provided more cheaply by placing power stations on the cheap coalfields and transmitting electricity to the south than by transporting coal to generating stations built in the southern counties. This is shown in Fig. 3.

The Generating Board recently decided to adopt 400 kV as the main transmission voltage. There is no great economic advantage to be gained at 400 kV, compared with 275 kV, for the transmission distances required in this country. The main reason, apart from technical advantages, for the adoption of 400 kV was that the carrying capacity at this voltage will be increased three times and therefore the impact of the Board's projects on the countryside, which is giving increasing concern, will be lessened because of the need for fewer lines and towers.



# PERSONAL AND SOCIAL

## News of Men and Women of the Industry

**Sir Ivan Stedeford**, who relinquishes the position of managing director of Tube Investments, Ltd., has agreed to remain as executive chairman until the end of next year. He will thereafter serve as a non-executive director. **Lord Plowden**, a vice-chairman of the T.I. group, will succeed Sir Ivan as chairman. Before joining Tube Investments Lord Plowden was chairman of the United Kingdom Atomic Energy Authority.

**Mr. R. D. Parker**, second assistant engineer (planning and development) in the Norfolk Sub-Area Engineering Department of the Eastern Electricity Board, has been appointed district engineer at Yarmouth. He succeeds Mr. J. E. Walker, who is now manager of the Colchester District. Mr. Parker received his early training with Johnson & Phillips, Ltd., and joined the Norwich Corporation Electricity Department in 1934 as a mains engineer, transferring later to development work. When the industry was nationalised he joined the Norfolk Sub-Area.

**Mr. G. H. Doust**, general manager of Plessey International, Ltd., has been appointed a director of the company.

**Mr. G. R. Hands** has been appointed to the board of Wolseley Engineering, Ltd., as marketing director and **Mr. F. Dean Swift** becomes sales director. Mr. Hands joined the company (for-

merly the Wolseley Sheep Shearing Machine Co., Ltd.) in 1936. After war service in the Royal Air Force he returned to the company and was appointed export manager in 1952. Mr. Swift has been sales manager since 1949.

**Mr. C. R. Wheeler**, whose appointment as vice-chairman of Associated Electrical Industries, Ltd., was announced in August, is to become deputy chairman of the company on 1st January. He will also be deputy chairman of the A.E.I. management companies.



Mr. R. D. Parker

The chairman of the I.E.E. East Midland Centre, Professor J. E. Parton, Head of the Department of Electrical Engineering at Nottingham University, presided at the Centre's annual dinner at Nottingham on 15th November. There was a record attendance of over 230 members and guests and about 50 had to be accommodated in another room to which the speeches were relayed. The toast of "The City of Nottingham" was proposed by Mr. O. S. Woods, assistant regional director, Midlands Division, C.E.G.B., and the Lord Mayor, Alderman J. Llewellyn Davies, responded.

The toast to the Institution of Electrical Engineers was proposed by Dr. J. A. Pope, research director, Mirreless National Research Division, who said that an easy way to lose money in industry was to produce something new. First-rate designers who could cut production costs were urgently required. If industry had to work on smaller margins, it would be difficult for it to bear the whole cost of research and development and this might then have to become partly a Government responsibility. Mr. C. E. Strong, hon.

treasurer of the Institution, who replied, said that the new divisional structure of the Institution would be very flexible. Mr. J. G. McMeeking, chairman, Regional Advisory Council for Further Education in the East Midlands, replied to the toast of "Our Guests" which was proposed by Professor Parton. The final toast, to the Centre chairman, was proposed by Lt.-Col. W. E. Gill, immediate past chairman.

**Mr. B. Pringle**, M.B.E., consultant and manager, Industrial Applications Engineering Department, A.E.I. Motor and Control Gear Division, has retired after 47 years with the company. During his career, Mr. Pringle has done considerable work on standardisation of electric motors at home and abroad, and has taken a leading part in similar work on Admiralty aircraft and B.E.A.M.A. committees, and with the British Standards Institution and the International Electrotechnical Commission.

**Mr. C. J. Evans**, A.M.I.E.E., has been appointed southern area sales manager of Efco Furnaces, Ltd. Mr. Evans, at present sales manager of the furnace department of the General Electric Co., Ltd., will take up his new appointment on 1st December.

The Birmingham and District Branch of the **Electrical Industries Benevolent Association** is holding its third annual Christmas luncheon on Thursday, 14th December, at the Grand Hotel, Birmingham. Tickets are obtainable from Mr. T. C. Browne, 26/28, Holloway Head, Birmingham, 1 (telephone: Midland 7921).

**Messrs. A. J. Bass, J. G. E. Davies, S. L. Ward and A. W. Wylde**, D.F.C., A.F.M., of the Transmission and Radio



At the annual dinner of the East Midland Centre of the I.E.E. (left to right): Professor J. E. Parton, Alderman J. Llewellyn Davies, Mr. J. C. McMeeking, Dr. J. A. Pope, Mr. R. H. Price, Mr. L. Adlington, Mr. O. S. Woods and Mr. J. B. Jackson



Towers Division of Blaw Knox, Ltd., have been appointed divisional directors.

**Mr. K. J. Coleman**, B.Sc.(Eng.), A.M.I.Mech.E., A.M.I.E.E., has been appointed chief engineer of Ketay, Ltd., a member company of the Plessey Group. Mr. Coleman was previously head of control and instrumentation of the Atomic Energy Department of Babcock & Wilcox, Ltd.



Mr. K. J. Coleman

Earlier he was with De Havilland Propellers, Ltd.

**Mr. H. Pickup**, B.Sc.Tech., M.I.E.E., who as reported in last week's issue has been appointed manager of the No. 2 (Huddersfield) Sub-Area of the Yorkshire Electricity Board, joined the Lancashire Electric Power Co. in 1932 and after the war, in which he served in the Royal Navy, attaining the rank of elect. lieutenant-commander, he was appointed district engineer and manager at Ormskirk. From 1949 until taking up his present position as sub-area engineer, No. 5 (Wakefield) Sub-Area, in 1952 he was with the South West Scotland Electricity Board (Glasgow).

**Mr. W. E. B. Nettleton**, M.I.E.E., manager of the No. 5 (Wakefield) Sub-Area, takes up a similar position in the No. 3 (Sheffield) Sub-Area. He held various positions with the Sheffield



Mr. H. Pickup



Mr. W. E. B. Nettleton



Mr. J. S. Yates



Mr. G. L. Tomlinson

Corporation Electricity Department between 1936 and 1949, becoming deputy distribution engineer. After nationalisation he was appointed engineer, No. 3 (Sheffield) Sub-Area and took up his present position in 1956. He was chairman of the I.E.E. Sheffield Sub-Centre in 1953-54.

**Mr. J. S. Yates**, M.I.E.E., succeeds Mr. Nettleton as sub-area manager at Wakefield. After service with the Bolton and Walsall undertakings, Mr. Yates became system planning and design engineer in the No. 2 (Bolton) Sub-Area of the North Western Electricity Board. He joined the Yorkshire Board as engineer, No. 2 (Huddersfield) Sub-Area, in 1956 and he was appointed deputy chief engineer to the Board at the end of last year.

**Mr. G. L. Tomlinson**, A.M.I.E.E., sub-area commercial officer, No. 3 (Sheffield) Sub-Area, is appointed manager of the No. 7 (Grimsby) Sub-Area. He was sales development engineer at Sheffield before taking up his present position with the Y.E.B. in 1948. Previously he had been with the Blackburn and St. Helen's undertakings.

**Mr. E. Cockcroft**, A.M.I.E.E., who becomes sub-area engineer, No. 5 (Wakefield) Sub-Area, has been with the Grimsby Sub-Area since vesting day; he became sub-area engineer in 1957. Previously he had served with the Halifax, West Bromwich and Barnsley Corporations.

About 80 members of the **Electrical Trades' Commercial Travellers' Association**, including two past-presidents, Sir Leslie Gamage and Mr. A. T. Haywood (now president of appeal for the Royal Commercial Travellers' Schools), attended the annual general meeting of the Association in London on 17th November. A motion that a National Council should be formed was ratified and officers for the new Council were elected. As a result a new London Branch has been formed with Mr. Frank Jarvis as chairman. The remaining four branches, Midlands, North-West, South Wales and Scotland, will now assume more responsibility and be given greater powers. All branches continue to

grow in strength and total membership now exceeded 1,000.

During the evening a cheque for £500, from the general fund of the Association, was handed to Mr. Haywood for the Schools, and Sir Leslie

Gamage received £200 on behalf of the Electrical Industries Benevolent Association. To the latter sum Mr. D. G. Barrie (Metway Electrical Industries) donated an additional £350. Further cheques totalling £268 (Schools) and £300 (E.I.B.A.) were presented by the remaining branches. Finally, Mr. J. G. Christopher (Thorn Electrical Industries) was installed as the new president and Mr. A. M. Scales as national chairman.

**Mr. D. H. Horton** has been appointed works manager of the E.M.B. Co., Ltd.

**Mr. T. Karen** has been appointed product design manager in the Major Domestic Appliances Group of Philips Electrical, Ltd., and **Mr. B. Dunne** becomes senior product designer. Both were formerly with A.E.I.-Hotpoint, Ltd.

**Mr. E. J. Blythe**, B.Sc.Tech., A.M.I.E.E., has been appointed chief

product engineer of Aircraft-Marine Products (Great Britain), Ltd. Following his graduate apprenticeship with the English Electric Co., Mr. Blythe held posts in research and development with Ferranti, Ltd., Standard Tele-



Mr. E. J. Blythe

phones & Cables, Ltd., and the M.O. Valve Co., Ltd. For the past ten years he has been concerned with the development and production of transmitting valves. Mr. Blythe will operate from the Aircraft-Marine head office in London.

Another new A-MP appointment is that of **Mr. A. Fowke**, D.F.H., Graduate I.E.E., G.I.Mech.E., who is now in charge of the A-MP laboratories. For the past 18 months he has been with John Brown (Special Engineering & Nuclear Developments), Ltd.

Among the awards of grants made by the Paul Instrument Fund Committee are the following:—£44,500, with the possibility of an increase to £52,000, to **Dr. V. E. Cosslett**, university lecturer in physics, University of Cambridge, to design and construct a very-high-voltage electron microscope and to explore its applications in biological research; £1,000, in supplement of a previous grant, to **Professor D. Gabor**, F.R.S., professor of applied electron physics at the Imperial College in the University of London, and **Dr. D. Jones**, for work on the



Mr. E. Cockcroft



development of an electron interference microscope; £2,500 to **Dr. N. Kurti**, F.R.S., reader in physics and senior research fellow, Brasenose College, Oxford, for the construction of a nuclear thermometer for use in the microdegree Kelvin temperature range; and £1,500, in supplement of a previous grant, to **Dr. J. H. Sanders**, university lecturer and demonstrator in physics, Clarendon Laboratory, Oxford, for the construction of an optical maser.

**Mr. N. E. Carnaby** has retired from the board of Lionel Robinson & Co., Ltd., and has also relinquished the post of London manager after 37 years with the company, 19 as a director.

**Mr. W. S. Lewis**, chairman of the Midlands Electricity Board, who is retiring at the end of the year, was guest of honour at a luncheon arranged for him by the Midlands Electricity Consultative Council at Birmingham Chamber of Commerce on Monday.

The chairman of the Council, Alderman the Rev. R. A. Giles, presented Mr. Lewis with a set of gold cuff links, bearing his initials in facsimile, in appreciation of what Mr. Lewis had done for consumers during his 14 years as chairman of the Board. **Mr. G. F. Peirson**, the chairman-designate, also attended the luncheon.

The Minister of Power has re-appointed **Mr. C. C. Hill**, B.Sc.(Eng.), M.I.E.E., M.I.Mech.E., as a member of the Eastern Electricity Board and **Mr. J. A. MacKerrell**, F.S.A.A., **Mr. W. H. Stokes**, C.B.E., J.P., and **Alderman E. A. C. Woodcock** as members of the East Midlands Electricity Board. The following part-time members have been re-appointed:—**Mr. J. Tristram Beresford**, South Western Electricity Board; **Mr. J. A. Duncan**, J.P., B.Sc., Merseyside and North Wales Electricity Board; **Mr. John Ryan**, C.B.E., M.C., M.A.(Cantab.), B.Sc., Southern Electricity Board; and **Mr. Basil Curran**, O.B.E., South Wales Electricity Board.

**Mr. A. I. Mackenzie**, B.A., C.A., has been appointed deputy chairman of the North of Scotland Hydro-Electric Board in succession to **Sir John Erskine**, G.B.E., D.L., J.P., who is retiring. **Mr. A. A. Fulton**, C.B.E., F.R.S.E., B.Sc., M.I.C.E., M.I.Mech.E., M.I.E.E., has been appointed a full-time member and **Lord Macdonald** a part-time member for the period to December, 1964; **Provost A. Macrae**, C.B.E., and **Mr. I. A. D. Millar**, M.C., M.A., A.M.I.C.E., J.P., are reappointed as part-time members to the same date.

**Mr. R. H. Wilson** has been appointed a director of Newalls Insulation Co., Ltd., as from 1st January next.



*I.E.E. North Midland Centre Dinner: The back row includes Mr. J. N. Griffiths (assistant hon. secretary, North Midland Centre); Mr. M. E. Broadbent (Centre vice-chairman); Prof. G. W. Carter (past chairman); Mr. W. K. Brasher (secretary I.E.E.); Dr. G. N. Patchett (Centre vice-chairman); Mr. J. Woodhouse (Centre hon. secretary). Front row: Air Chief Marshal Sir Leslie Hollinghurst; Mr. W. J. A. Painter (Centre chairman); Rt. Rev. Dr. J. R. H. Moorman, Bishop of Ripon; and Mr. G. S. C. Lucas (President I.E.E.).*

About 250 members and guests attended the annual dinner of the **I.E.E. North Midland Centre** at the Queens Hotel, Leeds, last Friday. The Centre chairman, Mr. W. J. A. Painter, presided. In proposing the toast of "The Institution of Electrical Engineers and the North Midland Centre," Air Chief Marshal Sir Leslie Hollinghurst, chairman of the National Industrial Fuel Efficiency Service, said that the Institution was one of the most virile and was doing a wonderful job in the educational sphere. Responding to the toast, Mr. G. S. C. Lucas, President I.E.E., stated that his Council did not share the view that the proposal for a joint body of the three senior engineering institutions to discuss matters of common interest would lead to integration. The toast of "Our Guests" was proposed by Mr. F. W. Fletcher, immediate past-chairman of the Centre, and the response was made by the Rt. Rev. Dr. John Moorman, Bishop of Ripon.

**Mr. Eric H. Cox**, M.I.E.E., assistant chief engineer (operations and communications) of the Midlands Electricity Board, has been appointed assistant chief engineer (distribution). Mr. Cox is a member of the Administrative Staff College and a member of the Joint Radio Committee of the Nationalised Fuel and Power Industries. In 1959 he visited the U.S.A. under the auspices of this committee, and in October, 1960, as joint author with Mr. R. E. Martin, he gained a premium for an I.E.E. paper on "Radio Communications in the Power Industry." Before nationalisation of the electricity supply industry he was with the Birmingham undertaking. During the war he served as a flotilla electrical officer in the Royal Navy.

Mr. Cox is vice-chairman of the South Midland Centre of the I.E.E. and is a past hon. secretary of the Centre.

**Mr. A. B. Brown** has been appointed a director of James Scott & Co. (Electrical Engineers), Ltd.

## OBITUARY

**Mr. D. V. Onslow**, A.M.I.E.E., M.Am.I.E.E., who died on 17th November, was with the Electrical Research Association for 40 years. Born in 1885, he was educated at Cheltenham College, and Christ's College, Cambridge. After serving with the Metropolitan Railway and Marconi's Wireless Telegraph Co., Ltd., he was appointed assistant manager of Gallott's Wireless Telegraph & Telephone Co., Ltd., and was engaged in supervising installations in England, France and Switzerland. This work was interrupted by the first world war during which he was occupied with the design and manufacture of wireless telegraph apparatus for the Admiralty by Creed & Co., Ltd. In 1921 he joined the E.R.A. as one of its first technical committee secretaries and was responsible for a wide range of subjects including insulating oils, insulators, steam turbine nozzles, steam tables, steels for high temperature, etc. During this period, in collaboration with the late Mr. E. B. Wedmore, he compiled the "Electrical Engineering Data Book." In 1948 he was appointed information officer to the E.R.A., a post which he held until the end of 1958 when he took up part-time duties as the first editor of *Co-operative Electrical Research*, the journal of the E.R.A. He leaves a widow and a daughter to whom we extend our sympathies.



## INDUSTRIAL NEWS

### Power Stoppage Averted

THE possibility of an interruption of power supplies as a result of the wages dispute in the electricity supply industry was removed by a settlement arrived at on 16th November. In response to a claim by the trade unions for an all-round increase of £2 a week in the wages of their members the Electricity Boards had offered an increase of 1½d or 1d an hour in the basic rate for skilled and unskilled men respectively, with an addition of 8s a week for skilled men and 5s for unskilled with three years' service or more. The increase was to take effect from 1st April next and to be repeated twice at two-yearly intervals.

This was unacceptable to the unions and after further discussion the Boards agreed to an increase of 2d an hour in the basic rate, to take effect from 28th January, and weekly increases for those with two years' service or more ranging, according to grade, from 5s to 8s 6d. It is proposed to put these employees on a weekly, instead of an hourly, basis. A meeting between the Board and union representatives is to be held early in 1962 to discuss productivity and improvement in the status of manual workers in the industry.

It is estimated that the increases, affecting about 120,000 employees, will cost £4½ million in the next year.

At a Press conference on 17th November called to discuss the impli-

cations of the settlement, Mr. R. S. Edwards, chairman-designate of the Electricity Council, said that two of the Area Electricity Boards were already expected to increase their charges but apart from this it was hoped that there would be no other increases during the 1962-63 financial year. Although he would have preferred to see the increases postponed until 1st April, the fixing of 28th January meant that there would be at least four months' delay from the date which the unions originally specified.

He thought that the Chancellor was right in calling for a "pay pause" but it was the case that the actual earnings of employees in the electricity supply industry (not the basic rates) were considerably out of line with those in private industry. He did not expect the increase to be "inflationary."

Last Monday Sir Robertson King, chairman of the Electricity Council, and his two deputy chairmen, Messrs.

C. T. Melling and R. S. Edwards, met Mr. Richard Wood, Minister of Power, to discuss the settlement. An official statement issued after the meeting explained that the agreement was made between the trade unions and the Electricity Boards and the Government had not directed or instructed the Electricity Council in the matter.

In the House of Commons on Tuesday Mr. Macmillan said that the settlement was not consistent with the pay pause. He urged all concerned, whether in nationalised industries, local government or private industry, to make every effort to maintain a policy of restraint over wages, salaries and dividends.

#### E.P.E.A. Annual Dinner

This evening (Friday) the Electrical Power Engineers' Association is holding its 34th annual dinner at the Connaught Rooms, London, W.C.2. The principal guests will be Mr. R. S. Edwards, D.Sc.(Econ.), chairman-designate of the Electricity Council, and Mrs. Edwards.

## MARKET RESEARCH AND EXPORTS

THE suggestion that a Government committee of inquiry be set up to study problems of export marketing was made by Mr. N. A. H. Stacey, economic and marketing adviser to the General Electric Co., Ltd., in an address to the University of London Department of Extra-Mural Studies and the Institute of Bankers last Tuesday.

Mr. Stacey put the chief blame for British industry's comparatively sluggish export performance on the worship of the production function which brought with it "a neglect of overseas marketing appraisals based on sound overseas marketing research." Superiority of technical and manufacturing skills, he said, had made British manufacturers disdain the importance of marketing. Yet reliance upon pro-

ductive excellence alone had not been able to sustain British exports in world markets.

After pointing out that Britain exported a smaller proportion of her gross national product than many of her competitors, Mr. Stacey said that though British industry spent £350 million on research and development to make better products, and the same amount on advertising them, it spent only £6 million in ascertaining where markets for the goods could be found. He claimed that the Americans spend "proportionately twice as much on market research as we do."

#### FEED PUMP DRIVES FOR FERRYBRIDGE

THE Heavy Plant Division of Associated Electrical Industries, Ltd., has received an order valued at £400,000 from G. & J. Weir, Ltd., covering eight 9,500 h.p., 11 kV motors for driving standby boiler feed pumps at the 2,000 MW Ferrybridge "C" power station, which is being constructed by the C.E.G.B. Midlands Project Group.

The motors will be of the variable-speed slip-ring induction type. They will be controlled by liquid rotor regulators over a speed range of 965-725 r.p.m., speed variation being necessary to match the water supply to the boilers to the steam demand of the main turbines. The main feed pumps are driven by bleed-steam turbines and the standby motor-driven pumps are brought in automatically under emergency conditions to ensure continuity of water supply, thereby safeguarding the boilers.

#### Toronto Hydro-Electric Report

In their fiftieth annual report the Toronto Hydro-Electric Commissioners trace the history of the system, showing how low rates and a high standard of service have aided its development. During the year ended 31st December, 1960, the gross income amounted to \$37.5 million, and the net income available was \$6 million. The peak load increased by 4 per cent to 615,491 kW, while the energy sold was 2 per cent higher than in 1959.

#### PURCHASE TAX READY RECKONER

A quick "ready reckoner" which saves retailers three calculations when working out the retail prices of Mazda valves and cathode-ray tubes has been produced by Thorn-A.E.I. Radio Valves & Tubes, Ltd., and is available from the company's Mazda Commercial Division, 155, Charing Cross Road, London, W.C.2.

**Domestic Supplement –  
Food Mixers, Kettles,  
Percolators and Toasters –  
at the end of this issue**



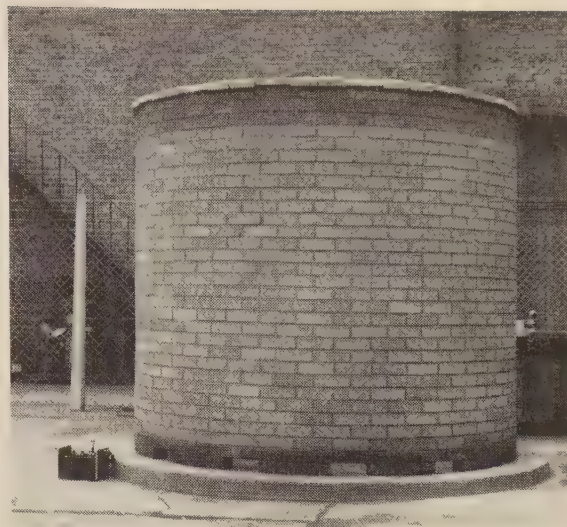
## TRANSFORMER NOISE SUPPRESSION

**A**N investigation is being carried out by Transformers (Watford), Ltd., into the use of a circular brick enclosure to suppress transformer noise. The advantages offered by such an enclosure include no maintenance and low cost, since a circular structure is inherently strong and a single brick thickness only without supporting buttresses is required. The absence of a roof ensures good access for high voltage bushings. An experimental TW-enclosure has been constructed by the company, using curved bricks supplied by the London Brick Co., Ltd., and a series of tests carried out with a 300 kVA distribution transformer operating at an excessive flux density to increase the noise level.

Sound volume was measured by a Dawe 1400 D meter at 8 positions with 45° spacing round the enclosure at distances of 1 and 6 ft and varying heights. Additional measurements were made at up to 40 ft from the enclosure and heights up to 30 ft above ground level. The measured noise level of the unenclosed transformer was 64.5 dB, while the average sound level adjacent to the enclosure was

43.5 dB and the maximum reading at any distance and up to 20 ft from the ground was 44 dB. All measurements were made at a 40 dB weighting. Tests taken at heights above the top of the enclosure and any distance from it did not show an increase in sound level.

An 8 ft diameter enclosure would be suitable for distribution transformers up to 500 kVA and could also house a switch and feeder pillar unit. Access could be by portable ladder as a door for this size unit might not be necessary. In comparison, enclosures of 16 and 19 ft diameter respectively would be



Brick noise suppression enclosure developed by Transformers (Watford), Ltd., for tests on a 500 kVA distribution transformer

required for 33 kV 10 and 15 MVA transformers. In these cases doors would be incorporated in the enclosure and the coolers would be mounted externally.

### MOVE TO POSTPONE E.T.U. RULES CONFERENCE

A motion by Mr. F. J. Chapple, a member of the Executive Council of the Electrical Trades Union, to restrain the Union from holding its Rules Revision Conference on 21st November was heard in the Chancery Division on 17th and 20th November.

Counsel for the applicant said that the injunction was asked for on the ground that there had been irregularities in the ballot for branch representatives to the conference. It was alleged that proposals to be made at the conference would remove questions of policy from the decision of the rank and file, and restrict the powers of the new Executive Council.

On Tuesday morning Mr. Justice Pennycuik, who had reserved judgment on Monday, said that on the evidence he considered that it would not be right to interfere with the holding of the conference. He nevertheless asked the Union to extend until 2 p.m. its undertaking not to hold the conference until the matter had been settled in case the applicant appealed. Later it was stated that Mr. Chapple had decided not to appeal and so the conference was allowed to proceed.

### Industrial Development Conference

**T**HE fifth Industrial Development Conference organised by the Electrical Development Association was held at Bournemouth last week and was attended by 125 delegates. After a civic reception by the Mayor and Mayoress on the Monday evening, the conference was opened on Tuesday by Mr. A. N. Irens (chairman, South Western Electricity Board), chairman of the E.D.A. Industrial Development Committee. Two papers were given, "New Developments in Industrial Lighting," by Mr. W. Robinson (E.D.A.), and "Steam and How to Raise it Electrically," by Mr. J. C. Edwards (Bastian & Allen, Ltd.).

On Tuesday afternoon delegates divided into groups to visit the works of the De Havilland Aircraft Co., Ltd., Max Factor & Co., the Wilton Royal Carpet Factory, Ltd., and Witchampton Paper Mills, Ltd. Wednesday was entirely devoted to visits, including the Esso Petroleum Co., Ltd., the Marchwood generating station, Dimplex, Ltd., B.R. Eastleigh Locomotive Works, Pirelli-General Cable Works, Ltd., the Ford Motor Co., Ltd., and the Mullard Radio Valve Co., Ltd.

Thursday morning's proceedings were presided over by Mr. R. R. B. Brown (chairman, Southern Electricity Board), chairman of the E.D.A. Council. Papers were given on "The Approach to Industrial Load Factor Improvement," by Mr. W. B. Parkinson (M.A.N.W.E.B.), and on "Elec-

trical Utilisation From the Consumer's Angle," by Lt.-Col. W. E. Dennis (George Wimpey & Co., Ltd.). In the afternoon further visits were arranged, this time to Wellworthy, Ltd., the U.K. Atomic Energy Authority, Flight Refuelling, Ltd., and Carter, Stabler & Adams, Ltd.

The chairman on Friday morning was Mr. C. T. Melling, C.B.E. (deputy chairman, Electricity Council) and papers were given on "Metal Melting From the Smaller User's Point of View," by Dr. A. G. Robiette, a consultant, and "The Principles of Industrial Control Systems and the Terminology Used," by Mr. R. S. Medlock (George Kent, Ltd.). An open forum was held in the afternoon, under the chairmanship of Mr. J. I. Bernard, director and secretary of E.D.A. The proceedings concluded with a dinner at which Mr. R. R. B. Brown presided. The guest speaker was Mr. S. P. Woodley, M.B.E. (assistant managing director, Vickers-Armstrongs (Engineers), Ltd.).

### British Order for Dutch Wired Television

More than 15 miles of special cable will bring wired television and v.h.f. radio programmes to some 5,000 houses in The Hague, Holland, as a result of an order for television distribution equipment placed with E.M.I. Electronics, Ltd., by P.T.T. Holland.



## INDUSTRIAL NEWS [continued]

## INDUSTRIAL PORCELAIN DEVELOPMENTS

ON Wednesday and Thursday of last week Doulton Industrial Porcelains, Ltd., entertained over 300 consultants, contractors and engineers from the electrical and allied industries at their headquarters in London. A 400 kV Doulton "Multicone" post insulator unit was displayed, with an example of the jig used for assembling the cone-shaped porcelain elements which are a feature of this design. Examples were also shown of disc and anti-fog disc insulators designed for 400 kV service and for uprating existing 275 kV strings to 400 kV.

An illustrated talk was given by Mr. W. A. McNeill, deputy managing director of the company, who dealt with the problems of producing insulators for operation at very high voltages, and of eliminating corona discharge. He said that in anticipation of the need to transmit even larger amounts of energy, development work was being carried out on insulators for 650 kV operation and that a prototype "Multicone" insulator at this voltage will be available for test early next year. The lecture and

exhibits illustrated that the increase in system voltages had produced a number of problems, amongst which visible corona level is of special interest. By studying electrolytic tank stress diagrams and by eliminating as far as possible small air gaps at the points of highest stress, it has been possible to produce overhead line insulators and posts which have corona levels of a high order. At the same time, stress rings and shields were simplified and kept to minimum dimensions.

The design of insulator sets which have been developed for 400 kV ser-

vice is the subject of a joint development by British manufacturers of this type of equipment under the direction of the C.E.G.B. The results of this investigation are not yet available for publication.

The Doulton "Multicone" post insulator for 400 kV, of a type described in the 2nd December, 1960, issue of the *Electrical Review*, has been modified and improved in the last 12 months. Electrical tests have been carried out with a variety of mounting arrangements, including high and low platforms and varying diameters and arrangements of busbars, including horizontal, vertical and inclined bars. Furthermore, tests have been staged with earth planes arranged in close proximity to the posts to simulate indoor substation conditions.

## POWER FOR ROYAL VISIT

At the urgent request of the Ghana Government, Mirreles and Brush engineers worked round the clock to complete part of the 30 MW power station at Tema before the arrival of the Queen and the Duke of Edinburgh. Three of the ten generating sets to be installed—Mirreles KVSS 16-cylinder turbo-charged diesels driving 3 MW Brush alternators—were commissioned several weeks ahead of schedule and on 7th November Accra received the first supplies of electricity in time to meet extra power demands caused by the royal visit.

The Tema power station and sub-stations, which will supply electricity for the harbour installations and the national grid, are being built under a £3 million contract by a consortium of three British companies—Parkinson Howard, British Insulated Callender's Cables, and the Hawker-Siddeley Group, who are the main contractors.

## A.S.E.E. to Move

The Association of Supervising Electrical Engineers has acquired new headquarters at 26, Bloomsbury Square, London, W.C.1, and hopes to be established there about the end of this month.

## Window Display Competition



Winning window display in the North Western Electricity Board's annual competition

THE 14th annual window display competition of the North Western Electricity Board has been won by the Stockport service centre, the winning window being a team effort by the staff. Entries for the competition numbered 107, the highest so far. The theme "Keeping Warm" gave scope for displays to feature any of the forms of electrical heating.

As always in this competition, displays had to be produced on a small budget. They were first judged on a Sub-Area basis and the final Area judging was conducted by a panel which, apart from Board members and senior officers, included display specialists.

The winning window made clever use of colour and design. Its main feature was a fortune teller, "Lady Electra," gazing into a crystal and foretelling "Secrets for Winter Warmth!" A main caption "Thank Your Lucky

Stars" surmounted a comprehensive display of heating appliances.

Wigan and Lytham service centres tied for second place. Other Sub-Area winners were Longsight, Rochdale and Dalton.

## NEW TRANSFORMER FACTORY

A new factory with a floor area of 7,500 sq ft has been acquired by Westool, Ltd., of Bishop Auckland, Co. Durham, for the production of transformers. Arrangements have already been made to secure adjacent land for further development.

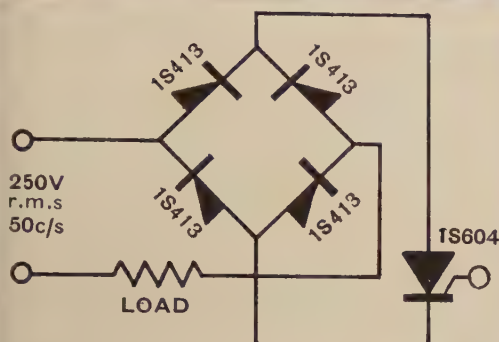
## Price Reductions

Easco Electrical (Holdings), Ltd., have reduced the prices of several items in their "Eascolyte" battery operated fluorescent lighting range.



# THIS A.C. PHASE CONTROLLED SWITCH NEEDS ONLY ONE S.C.R. TO HANDLE FULL 850W LOAD

## TEXAS SILICON CONTROLLED RECTIFIERS HIGHER EFFICIENCY REDUCES COSTS



ACTUAL  
SIZE

The circuit shown requires only one silicon controlled rectifier, thus reducing costs in many applications. A.C. mains voltage is applied to a bridge rectifier in series with the load. The current is controlled by operating the silicon controlled rectifier, which is placed across the bridge, as a switch. The S.C.R. is fired by a pulse generator which can be based upon a complementary bistable circuit using Texas 2S301 and 2S701 silicon industrial transistors.

Type	Description	Peak Inverse Voltage and Forward Breakover @ 125°C* P.I.V. (V)	Max. Mean D.C. Forward Current		Max. Gate Current required to turn device on $I_{GF}$ (mA)	Max. Sustaining Current $I_H$ (mA)
			@ 65°C* $I_o$ (A)	@ 125°C* $I_o$ (A)		
1S600	Stud mounted device with an extremely small gating power requirement	50	3	1	20	25
1S601		100				
1S602		200				
1S603		300				
1S604		400				
1S610	Mounted in a standard TO-5 transistor case and having a 1A rating	50	1	0.3	20	25
1S611		100				
1S612		200				
1S613		300				
1S614		400				

\*Stud or case temperature.

HYDRATRON ADVANTAGES WITH SEMICONDUCTOR RELIABILITY  
PRODUCED BY TEXAS FOR INDUSTRY

TEXAS



INSTRUMENTS  
LIMITED

MANTON LANE · BEDFORD · ENGLAND  
BEDFORD, 67466 · CABLES: TEXINLIM, BEDFORD



# 'HIDUTAC' switchfuses pack more space into a smaller size

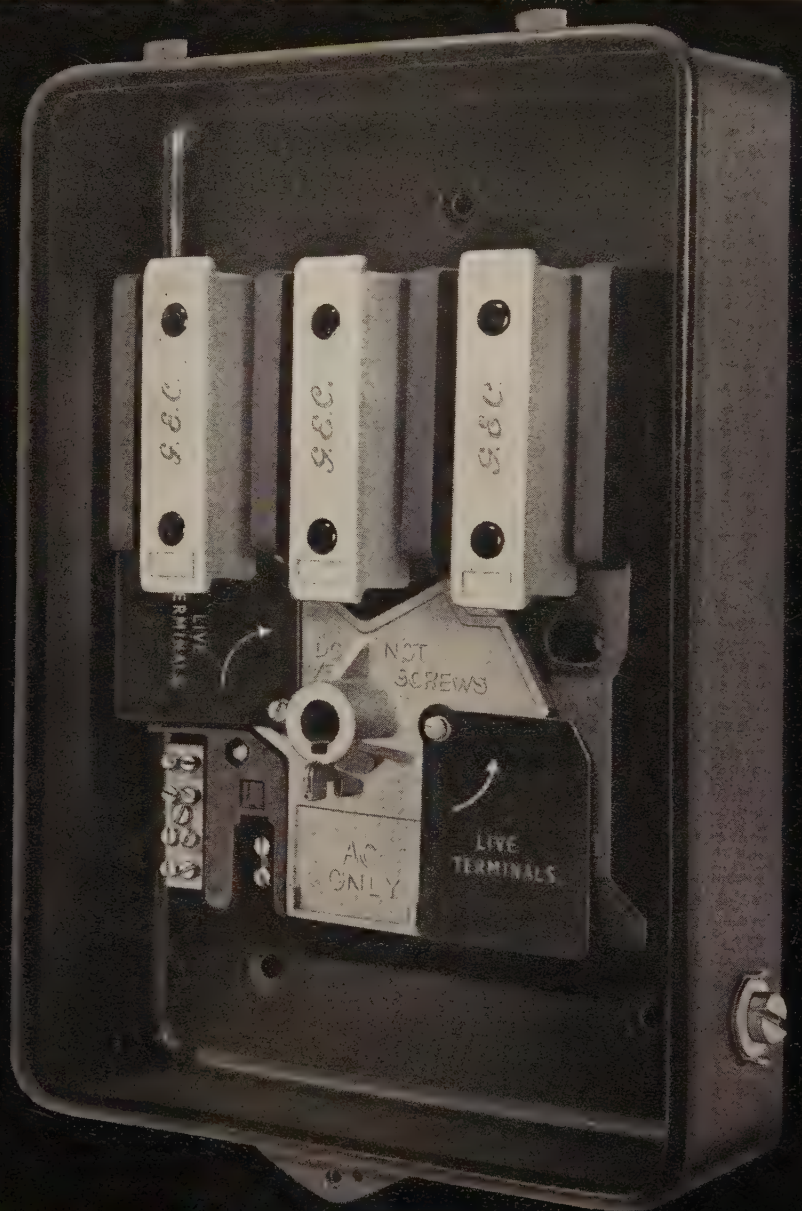


Radial positioning of the contacts of 'Hidutac' switchfuses allows a *unique compactness*. This is just one of many 'Hidutac' exclusive features resulting from G.E.C. Installation Equipment Group's *new approach*, based on many years' experience of making switchgear superbly well. The 60 amp. TPN 'Hidutac' measures only  $13\frac{3}{16} \times 8\frac{1}{2} \times 4\frac{1}{2}$  in. yet there is still generous wiring space and easy access to the terminals at the front.

Consider these other impressive advantages: *Unlimited full load switching*—'Hidutac' switchfuses operate at their full load current with unfailing reliability. *High breaking capacity*—8 times the rated full load current—through cam-operated, double-break, silver contacts. *Total internal enclosure* of all moving parts, with shields over live terminals. *High fault current protection* in Single Pole and Neutral, Double Pole, Triple Pole, Triple Pole and Neutral switchfuses with H.R.C. or rewirable fuses. Categories of duty are: H.R.C. fuses, all ratings, AC4 of BS88 (33,000 amp.); rewirable fuses, 15 and 30 amp. ratings, S2A of BS3036 (2,000 amp.); rewirable fuses, 60 amp. rating, S4A of BS3036 (4,000 amp.). *Modern styling* of pressed steel case with fully interlocked cover.

These exclusive features make 'Hidutac' switchfuses vastly superior for tungsten and discharge lighting control, motor control, and transformer and capacitor switching.

**IMMEDIATE DELIVERY** of 'Hidutac' switchfuses from wholesalers throughout the country. For more detailed information ask your wholesaler for 'Hidutac' literature.



that's the New Approach of **S.E.C.**

INSTALLATION EQUIPMENT GROUP

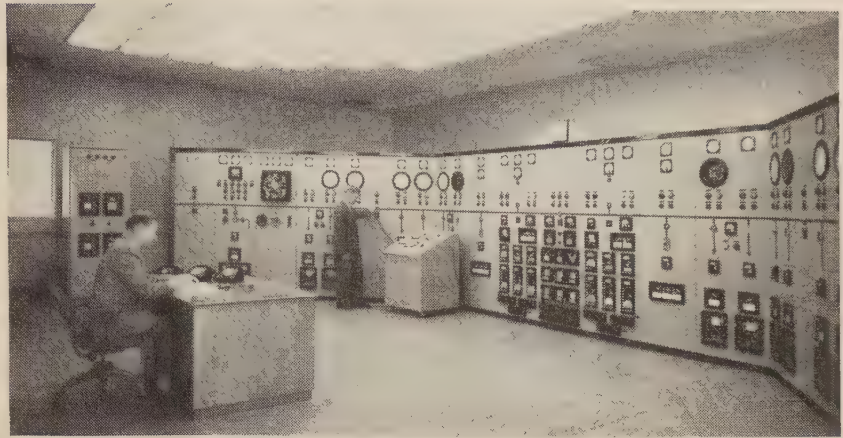


## Electric Pumps for the Severn Tunnel

THE seven plunger and five bucket type steam-driven Cornish beam engines, which have been pumping an average of 20 million gallons of water daily from the Severn Tunnel, were installed by the former Great Western Railway in 1886 and are now being replaced by "Electromersible" pump units, supplied and installed by Hayward Tyler & Co., Ltd., of Luton. Each unit consists of a 9 cusec, single-stage, submersible, centrifugal pump driven by a direct-on-line starting submersible 1,450 r.p.m. motor, supplied at 3.3 kV. The pumps deliver from 150,000 to 200,000 gal/hr depending on the depth of the shafts which vary from 140 to 200ft.

The power supply is obtained from the South Wales Electricity Board through duplicate 11 kV feeders and this is transformed at site to 3.3 kV to feed the main h.v. switchboard for supplying the pumps. Power for auxiliaries, lighting and heating is provided by two 3,300/415 V transformers. Two 1,345 kW diesel alternator sets have been installed for a standby supply.

The pumping station is operated from a central control room. The main switchboard provides switching for the pumps, standby sets, and pump discharge valves and gives indication of pump outputs, water levels in each shaft and all necessary data associated with the installation. Duplicate, submersible low-voltage units, each with



Central control room for the Severn tunnel pumping station

a capacity of 80,000 gallons per hour, have been installed near Pilning on the opposite bank of the river, replacing a further two Cornish beam pumping engines. This plant is automatically operated from the Sudbrook control room. All the electrical equipment, which includes the switchgear, control

switchboard, standby sets, auxiliary transformers and cabling to each shaft, etc., was provided and installed by the Brush Electrical Engineering Co., Ltd. Work will commence in 1962 on the electrification of the tunnel ventilating system, which is also situated at Sudbrook.

### Diamonds in Industry

To meet the needs of students and engineers who require basic information about the varied uses of industrial diamonds, the Industrial Diamond Information Bureau has published a booklet entitled "Diamonds in Industry—An Introduction." After reviewing the range of applications which depend on hardness, an account is given of new uses. The semi-conducting and other properties of type IIb diamonds, for example, make them an excellent thermistor material. Diamonds are also used as radiation detectors in nuclear research and as transistors in radio receivers. Other new applications may be discovered at the Diamond Research Laboratory, where a high-voltage electron accelerator is being used in an attempt to change some of the properties while leaving others unchanged.

Copies of the booklet may be obtained free of charge from the Bureau at 2, Charterhouse Street, London, E.C.1.

### INDIAN INDUSTRIES FAIR

THE company's contribution both to the Indian industrial revolution and to power developments throughout the world forms the main theme of the stand of Associated Electrical Industries, Ltd., which occupies 2,000 sq ft of the United Kingdom Pavilion at the Indian Industries Fair in New Delhi. Working models, photographs, films and other devices are used to show some of the 3,500 types of equipment which A.E.I. makes and supplies to all parts of the world.

Dominating the central section is a large map giving the sites of eight main projects with which the company has been concerned. One of these is the heavy electrical plant being built in Bhopal by the Indian government at a cost of £85 million with A.E.I. as

consultants. Stress here is laid on the special training scheme which the company is establishing for this project; this enables 3,000 men to be trained at a time. Other important schemes are the Durgapur Steel Works and electric railway and traction developments including those in Bombay and Calcutta.

### St. Vincent Hydro-Electric Scheme

Work on the St. Vincent Electricity Services' new £250,000 hydro-electric scheme at Richmond is now well advanced and Barclays Bank D.C.O. reports from the island that it is expected to be completed in December this year. This scheme, undertaken by the Colonial Development Corporation, will double the generating plant capacity in the island and will enable the company to meet the steadily rising demand for power for several years to come.

### "WIRELESS WORLD" DIARY

Answers to many questions on radio and television subjects will be found in the 80 pages of reference material in the *Wireless World* Diary for 1962. Some idea of the variety of information it includes will be gathered from the following selection from its contents:—Addresses of over 150 radio and allied organisations in this country and abroad; tabulated details of the world's television standards and the countries using them; dimensions for the elements of aerials for television and v.h.f. sound broadcasting; tabulated connections for transistors and some 300 current receiving valves; channels and frequencies of U.K. television stations; and graphical and letter symbols used in radio.

The diary is published by T. J. & J. Smith, Ltd., 12, Hanover Square, London, W.1., in conjunction with *Wireless World*, price 6s 6d leather or 4s 6d rexine, plus 4d postage.



## INDUSTRIAL NEWS [continued]

## C.E.G.B. CONTRACTS

THE Central Electricity Generating Board has placed contracts during the past month for power stations, transmission lines and transforming stations amounting to approximately £6,800,000. They include the following:—

Blyth "B" power station: dust-handling plant.—Babcock & Wilcox. Two 400 MVA, 275 kV generator transformers, Nos. 7 and 8.—Ferranti. 11 kV switchgear and accessories.—A. Reyrolle & Co.

Thorpe Marsh power station: main and auxiliary cables and accessories.—Pirelli-General Cable Works. No. 2 turbo-alternator block.—Mitchell Construction Co.

West Burton power station: drain pump in Burton Round.—Laneham Internal Drainage Board. Ash- and dust-handling plant.—Babcock & Wilcox. Two 110-ton overhead electric travelling cranes for turbine house.—Cowans Sheldon & Co.

## Lead Cable Sheathing

The second publication in the series issued by the Lead Development Association to stimulate interest in the use of lead in cable sheathing has now been published. Both lead and lead alloys possess impermeability to moisture and good corrosion resistance. For certain cable construction and conditions of installation, however, it is essential to employ a lead alloy to meet special needs. This booklet, "Lead Cable Sheathing—Alloy Characteristics and Applications," describes these special requirements and explains how they may be met by selection from the lead sheathing alloys commonly available in the United Kingdom.

An information sheet for each lead alloy is included, giving full details of compositions, characteristics and the type of cable and installations for which the alloy is suitable. Copies are available from the Association at 34, Berkeley Square, London, W.1.

## FORK TRUCK STABILITY TESTS

The British Industrial Truck Association has issued a booklet containing the tilting platform tests for fork lift trucks which have been adopted by members. Copies, price 2s 6d, may be obtained from the Association at York Mansion, 94-98, Petty France, London, S.W.1.

Drakelow "C" power station: control panels, desks and equipment.—George Kent.

Droylsden substation: Two 132/33 kV, 90 MVA transformers and auxiliaries.—Crompton Parkinson.

Wavertree and Lister Drive substations: three 132/33 kV, 60 MVA transformer auxiliaries.—Crompton Parkinson.

Kearsley (Slackey Brow) substation: building and civil engineering work for new 132 kV switch house and control buildings.—Yorkshire Hennebique Contracting Co.

Bury St. Edmunds substation: two 132/33 kV, 60 MVA transformers.—C. A. Parsons & Co.

Ashford and Ruckinge substations: 132 kV switchgear.—English Electric Co.

East Ham substation: 66 and 11 kV cabling.—Pirelli-General Cable Works.

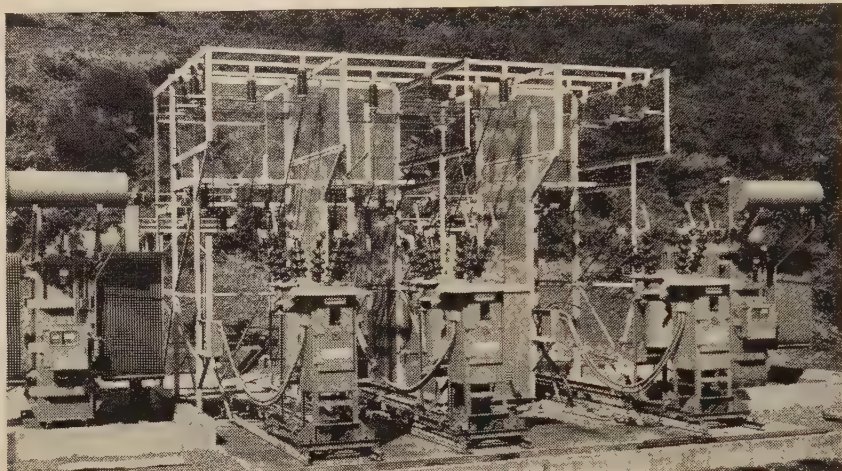
Sydenham substation: two 45 MVA, 132/33 kV transformers.—Hackbridge & Hewittic Electric Co.

Betteshanger substation: two 60 MVA, 132/33 kV transformers.—Yorkshire Electric Transformer Co.

Wimbledon-Wandsworth: 132 kV underground cabling.—Pirelli-General Cable Works.

Beddington-Purley: 132 kV underground cabling.—Enfield Standard Power Cables.

## Packaged Outdoor Substation



The National Coal Board's Windsor colliery 33 kV substation illustrated incorporates a metalclad control room behind the central circuit-breaker. A galvanised angle iron framework supports the insulators, busbars, etc., while the conventional circuit-breakers have been provided with wheels, running on rails, to give horizontal isolation. Separate isolators are thus not required

## Popular Guide to Transmission Lines

The factors that govern the design and siting of overhead transmission lines are explained in simple non-technical terms in an attractive new booklet "Network for the Nation." It has been written and illustrated by Mr. G. B. Jackson, formerly overhead lines engineer, C.E.G.B., and now assistant regional director, North East Region. Copies can be obtained from the Public Relations Dept., C.E.G.B., Winsley Street, London, W.1.

The book is not a justification of the use of these lines but it should lead to a clearer appreciation of the Board's difficulties. Transmission lines are not as simple as they look. Sir Christopher Hinton says in an introduction: "We in the Generating Board give much of our time to understanding the problems of Planning Officers, Land-

owners, Amenity Societies and others for it is only by this mutual understanding that there is hope of solving the great difficulties that are constantly met." The Board has also published an illustrated summary of its 1960-61 report.

## Report on D.C./A.C. Convertors

The British Scientific Instrument Research Association has published a research report entitled "D.C./A.C. Convertors for D.C. Amplifiers," by E. Komolibus. All known types of d.c./a.c. convertor are covered, and data are given on all convertors commercially available in the United Kingdom. The report (price £2 2s) contains 130 pages, including 70 pages of circuits and diagrams.



INDUSTRIAL NEWS *[continued]*

## TRADE ANNOUNCEMENTS

On 1st December **Telcon Plastics, Ltd.**, of Farnborough, Kent, is re-opening the branch at 16/17, Hills Terrace, Cardiff, previously operated by the Telegraph Construction & Maintenance Co., Ltd. The company, which already has branches in Manchester and Dudley, is a member of the B.I.C.C. Group and manufactures thermoplastics sheeting, powders, tubing, mouldings, coated papers and laminates, stocks of which will be held at Cardiff. Mr. G. Morecroft will be in charge of the branch as area representative.

The Control Gear Division of **G.W.B. Furnaces, Ltd.**, have been appointed sole licensees in Great Britain for the complete range of moulded case automatic air circuit-breakers designed by the Sace Company of Bergamo, Italy.

The Leeds branch of **Santon, Ltd.**, has been moved to larger and more convenient premises at 123, Water Lane, Leeds, 11 (telephone: Leeds 28762 and 35671).

**Ekco Heating & Electrical, Ltd.**, have appointed Mr. D. Sinyard as sales representative covering Lancashire, Cheshire and North Wales. His

address is 169, Hollin Lane, Middleton, Manchester (telephone: Middleton 3840).

On 11th December the offices of **Utilities (London), Ltd.**, will be transferred to 108, Auckland Hill, West Norwood, London, S.E.27 (telephone: Gipsy Hill 0166/8).

Under an exclusive licence agreement with Hastings-Raydist, Inc., U.S.A., **J. Langham Thompson, Ltd.**, are to market and subsequently manufacture the full range of Hastings-Raydist vacuum gauges, altimeters, air velocity instruments, flow meters, electrovertors, etc. Initially they will stock vacuum gauges.

Mr. N. E. Wilkinson has joined the northern branch of **Dimplex, Ltd.**, and is based at the company's premises at Leestone Road, Wythenshawe, Man-

chester. His duties include handling domestic, commercial and industrial heating schemes and also selling to architects, builders and estate developers.

The **Electrical Remote Control Co., Ltd.**, have appointed Mr. W. A. Abbotts as their technical representative for Birmingham, Shropshire, Staffs., Derbys., Worcs., Notts., Leics. and Warwicks. His address is 5, Larkfield Avenue, Castle Bromwich.

Mr. A. J. Herbert, of 19, Old Church Road, Whitechurch, Cardiff, has joined **Sunbeam Electric, Ltd.**, and will be working as a retail representative with Mr. R. W. Beer, the company's area manager for South Wales and the West.

**B. & R. Relays, Ltd.**, have been appointed sole selling agents in Great Britain for the range of dry reed switches manufactured by the Gordos Corporation of America.

## A.E.I. Hydro-Electric Generator for Norway

A Norwegian order worth approximately £300,000 has been secured by the Heavy Plant Division of Associated Electrical Industries, Ltd., for a waterwheel generator. The machine, rated at 140 MVA, 300 r.p.m., 17 kV, has been ordered by the Norwegian State Power Authority (Norges Vassdrags-og Elektrisitetsvesen) for operation with a 150,000 h.p. vertical Francis turbine in the Tokke III underground power station, about 100 miles west of Oslo. Tokke I was officially opened earlier this year by the Norwegian Prime Minister and Tokke II and III are expected to be commissioned during 1964; a fourth station is planned for future construction.

## Anglo-Japanese Trade

Pending completion of the trade negotiations now taking place between Britain and Japan, the two Governments have agreed to issue import licences on an interim basis for all goods for which there were quotas under the trade arrangements which expired on 30th September.

## Parliamentary Report

### Equipment for Air Traffic Control

Eurocontrol, the new organisation established by West European countries to provide air traffic control in the upper air space, will give the British electronics industry an exceptional chance to play a leading part in supplying air navigation equipment throughout Europe, the new Parliamentary Secretary to the Ministry of Aviation, Mr. Christopher Woodhouse, said in the House of Commons last week.

The United Kingdom, he added, already had a leading place in the development of all kinds of electronic equipment of the sort that Eurocontrol would need to use. In the initial stages Eurocontrol could be expected to use, and use against reimbursement, the existing British system over the United Kingdom, although it would of course be responsible to the international organisation and be integrated with the systems of other countries.

### No Power Station for Durham Yet

Although the Central Electricity Generating Board has the question of a new power station for the Durham area under review there is no prospect of a station being built in the near future, Mr. Norman Pentland, Labour M.P. for Chester-le-Street, was told. Mr. J. C. George, Parliamentary Secretary to the Ministry of Power, pointed out that the C.E.G.B. planned its power station commissioning programme five years ahead. Even if it

was decided to build a station it would be some years before construction could begin.

Mr. Pentland pressed the Parliamentary Secretary to do everything he could to speed up the decision. "This is of extreme importance in the Durham coal field, particularly in view of the decision to import liquid methane into Britain," he said.

### Talks on Electricity Finance

Mr. Richard Wood, the Minister of Power, said that discussions between the Ministry and the Electricity Boards on the implementation of the policies set out in the command paper on the financial and economic obligations of the nationalised industries were still continuing. He promised an announcement as soon as the talks had been completed on the financial objectives to be set for the Area Boards.

### Computer to Aid Minister

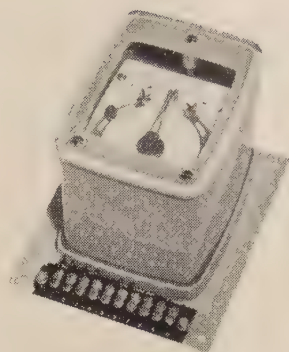
An electronic computer will be used to analyse data on traffic flow for the comprehensive survey of London's traffic now being made by consultants on behalf of the Ministry of Transport and the London County Council, Mr. Ernest Marples, Minister of Transport, has told M.P.s. In a written reply he said he was also considering, with the Road Research Laboratory, the possibility of using a computer for the continuous processing of traffic data to permit the co-ordinated control of traffic over large areas.



## NEW ELECTRICAL EQUIPMENT

### CENTRE ZERO MOVING COIL RELAY

An extension of the range of moving coil relays by the addition of a centre zero relay is announced by AUSTINLITE, LTD., Schomberg House, 82, Pall Mall, London, S.W.1, a member of the Stone-Platt group. The magnet system incorporated provides sufficient torque when a low current is applied to give a reliable contact performance. Fixed contacts for high and low current conditions are nominally adjustable to close at any pre-set point between  $\frac{1}{2}$  mA and  $1\frac{1}{2}$  mA. Development of relays operating off lower and higher currents is proceeding.



Above: Austinlite centre zero moving coil relay

### SINTERING FURNACE

A high vacuum / high temperature sintering furnace has recently been produced by SPSEMBLY, LTD., New Road Avenue, Chatham, Kent. The furnace element consists of four tungsten strips formed into a tube 12 in long, clamped in such a way that the cooling water pipes (which also carry the current) are coiled round the outside of the element to form a spring to reduce stresses in the element to approximately zero at maximum temperature. There are tantalum radiation shields between the coil and the element. The furnace body is of stainless steel. Samples for heating are loaded into a tungsten or tantalum crucible through a port. The charge capacity is about  $2\frac{1}{2}$  in long by  $\frac{3}{4}$  in diameter.

The vacuum system consists of a 3 in oil diffusion pump backed by a gas-ballasted single-stage rotary piston pump. The furnace is normally metered down to  $10^{-5}$  mm Hg, but at the operating temperature of  $2,400^{\circ}\text{C}$  the theoretical ultimate is  $10^{-6}$  mm.

Various alternative power supply arrangements are provided, ranging from manual tap-changing or stepless saturable reactor control to fully automatic programmed cycle controls. With the manual control an optical pyrometer is used as a temperature indicator, and with the automatic control, a total radiation pyrometer feeds a stepless indicating controller of the galvanometer pattern. The transformer is rated at 12 kVA 415/25 V and controlled either by a tap changer or a saturable reactor. Consumption of the furnace at  $2,400^{\circ}\text{C}$  in a  $10^{-6}$  mm

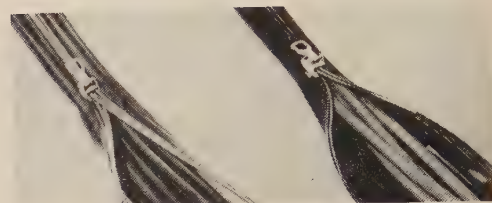
Right: Portable Welders spot welding timers

Hg vacuum is about 10 kVA. It is possible to reach this temperature in 5 minutes or less from cold and without a charge; cooling to  $200^{\circ}\text{C}$  takes place in about 10 minutes, due to the low thermal mass of the element and shields. Control can be continuous from about  $1,000^{\circ}\text{C}$  to  $2,500^{\circ}\text{C}$ . The furnace can be arranged in various ways, including glove-box mounting, but it is generally mounted on a cubicle measuring approximately 4 ft by 3 ft by 4 ft high, containing all the controls, vacuum equipment and the transformer.

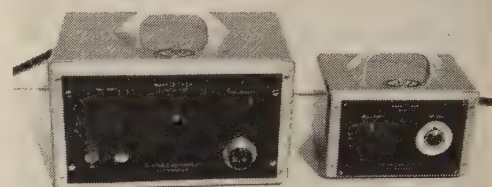
### SPOT WELDING TIMERS

Two fully transistorised timing devices have been announced by PORTABLE WELDERS, LTD., Castle Mills, Buckingham, for use with their range of maintenance and production spot welding guns. The Mark II, with a 210/250 V input, is designed to switch 30 A line current. Initiation is by closure of low voltage contacts in a microswitch, and the timer has an accuracy of  $\pm 1$  cycle with a  $\pm 10$  per cent mains variation. The Mark IV, with a 240/415 V input, is designed to switch 100 A line current. The timer has an accuracy of  $\pm 1$  cycle or 1 per cent whichever is the less, independent of a mains variation of  $\pm 6$  per cent.

The time cycle of both timers is from 2 to 50 cycles and is determined by the discharge of current from a



Hellermann "Helazipp" flexible cable binding



low loss storage capacitor into the base of a switching transistor. The duration of the current discharge is determined by a variable resistor. Both timers are fitted with sockets to take plugs on the floating 20 ft lead from the welding guns. They are designed specifically for the company's S.15, S.20, S.80 and S.120 guns, but can be used with other equipment where accurate electronic control is required. They are priced at £28 10s for the Mark II and £60 for the Mark IV, respectively.

### CAPTIVE SCREW TERMINAL BLOCKS

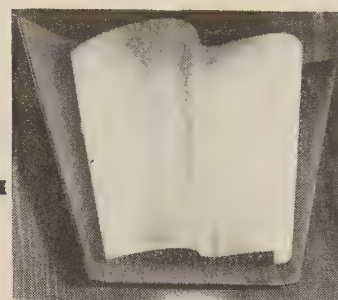
The flexible polythene 12-way terminal blocks announced by METWAY ELECTRICAL INDUSTRIES, LTD., Metway Works, Canning Street, Brighton, 7, are being marketed in four sizes—5, 10, 20 and 30 A. The colour is silver-grey and all metal parts are plated. The blocks are designated "Captive-way," because once the screws are fixed they are retained by three internal projections. The list prices, subject to quantity discounts, are 2s 6d per 12-way block for the 5 A size, 3s 9d for the 10 A, 7s for the 20 A and 8s 6d for the 30 A.

### FLEXIBLE TAPE CABLE BINDING

The latest cable binding, known as "Helazipp," introduced by the Plastics Division of HELLERMANN, LTD., Gatwick Road, Crawley, Sussex, is a



Courtney, Pope type TF.58 wall-mounted lighting fitting



flexible p.v.c. tape with interlocking beading along each edge, which when wrapped round the length of cables interlocks by "zipping" the two sides together. This covering is dust- and moisture-proof, tough and lightweight. It is available in either black or transparent finish and can be used in place of conduit or in certain circumstances as a cover for conduit giving protection from corrosion. The wall thickness of this covering is 0.015 in to 0.020 in and it is available with internal diameters of  $\frac{3}{8}$ ,  $\frac{1}{2}$ ,  $\frac{3}{4}$ , 1,  $1\frac{1}{2}$ , 2,  $2\frac{1}{2}$  and 3 in.

### CENTRAL HEATING CONTROL UNIT

A compact control unit for central heating systems in the form of a timer operating in conjunction with three 5 A toggle switches, each with neon indicators, has been developed by VANNER, LTD., Kingston By-Pass, New Malden, Surrey. Three circuits may be operated, each with the alternative of manual control or time switch control covering two daily switching periods.

When used for a heating installation one switch controls the boiler and the second controls the pump. Should hot water circulation not be required the pump is switched off, leaving the boiler operating under time switch control to provide domestic hot water.

The third circuit is available for the larger installation where a fan is used to circulate air through a heat exchanger. During summer months the boiler is left in the "on" position for hot water supplies, the circulating

pump "off" but the fan "on" for the circulation of cool air. Known as the "Three Switch Autopoint," the control unit is priced at £7 2s 6d.

### FAN HEATERS

Two new fan heaters have just been placed on the market by DAVID C. LESSER & Co., LTD., 510a, Coventry Road, Birmingham, 10. The first, the "Petite," although only small in size, has a loading of 2 kW and is fitted with a thermal cut-out. It has a four-position switch permitting operation on half heat, or cold air circulation. The finish is in red and chromium and it is mounted on a swivelled chromium plated tubular stand. The price, including purchase tax, is £6 10s.

The second appliance is the "Lucerne" turbo-heater, which also has a maximum heat output of 2 kW. Like the "Petite," it is fitted with a four-position switch and is also mounted on a swivelled stand. It has a two-tone finish in lemon/black and the stand is of tubular aluminium. The price, including purchase tax, is £9 19s 9d.

### RE-STYLED EKCO "THERMOTUBES"

Specially designed styling strips for mounting between banks of "Thermotube" tubular heaters are now being made by the EKCO HEATING & ELECTRICAL CO., LTD., 41/47, Old Street, London, E.C.1. The strips, which are said to greatly enhance the appearance of the heaters, are available in 2, 3

and 4 ft lengths and cost 6s 6d, 7s 6d and 8s 6d, respectively.

### WALL-MOUNTED LIGHTING FITTING

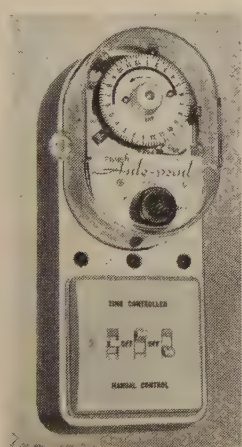
The latest wall-mounted lighting fitting to be produced by COURTNEY, POPE (ELECTRICAL), LTD., Amhurst Park, Tottenham, N.15, has rather an unusual but nevertheless striking design. It consists of a shaped wood veneer backplate on to which a double curved "Perspex" diffuser is clipped. This diffuser can easily be removed in order to gain access to the two 60 W lamps required for the fitting. The overall depth of the fitting, type TF.58, is 11 in and the price is just under £8 5s.

### SEMICONDUCTOR DEVICES

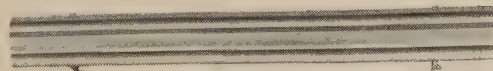
Several new products have been announced by HUGHES INTERNATIONAL (U.K.), LTD., Glenrothes, Fife, Scotland. These include the HS3100 series high conductance, low leakage, 200 mA diodes for high voltage applications. They are available in a p.i.v. range of 300-1,000 V. The 1N645-9 is a sub-miniature 400 mA diode/rectifier for power supply and switching applications. Silicon cartridge rectifiers are also available. The HSC1 series of epoxy resin encapsulated high voltage diode assemblies has a p.i.v. range of 300-1,000 V. The (N645-9 100 mA. Small size is a feature of these, the 5 kV unit being only 1.5 in long and 0.5 in in diameter. Non-standard assemblies of shorter length (up to 8 kV/in), higher current rating or higher speed, are available to special order.

### DIGITAL VOLTMETER

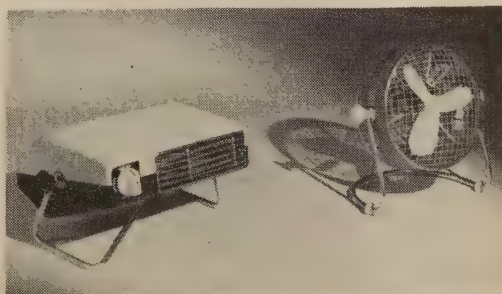
An addition to the range of digital voltmeters made by SOLARTRON LABORATORY INSTRUMENTS, LTD., Cox Lane, Chessington, Surrey, is the LM 1010, which measures d.c. voltages from 20  $\mu$ V to 1.5999 kV, with polarity discrimination, and provides simultaneous print-out signals within 20 msec. Voltages are measured with an accuracy of  $\pm 0.05$  per cent of read-



Vanner "Three Switch Autopoint" control unit for central heating systems

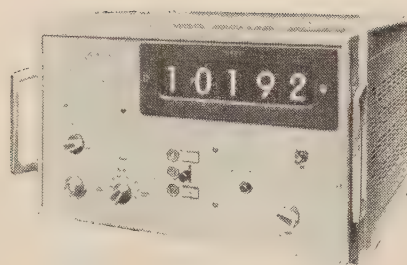


A bank of Ekco "Thermotubes" with the new styling strip



The two new Lesser fan heaters—the "Lucerne" (left) and the "Petite"





Solartron LM 1010 digital voltmeter

ing or  $\pm 1$  bit, whichever is the greater. On the most sensitive of the five ranges the 1 bit resolution is  $20 \mu\text{V}$ . Two other additional ranges have scaling suitable for iron/constantan and chromel/alumel thermocouple inputs to give direct temperature readings. A switched filter network also gives approximately 20 dB attenuation of mains ripple that may be present on the input. Input impedances of  $1,000 \text{ M}\Omega$  on the two most sensitive voltage ranges and the two thermocouple ranges enable the instrument to be used in the capacitance transfer method of d.c. voltage measurement.

The voltmeter can be switched for manual or auto operation. In the manual mode a single input sample is taken by pressing a panel button. The reading thus displayed remains unaltered until successive samples are taken. On auto the input is sampled at mains frequency, i.e. 50 or 60 samples per second. The five-figure digital display is by optical projection with red or black backgrounds to indicate positive or negative inputs respectively. Decimal outputs at  $-12 \text{ V d.c.}$  are extended to a 75-way rear mounted socket for driving an in-line printer or remote digital display. Overall dimensions are 10in by 18in by 16in and the weight is 50 lb.

### SURFACE TEMPERATURE SENSOR

A platinum resistance surface temperature sensor, the E100A, has been developed by RESEARCH & ENGINEERING CONTROLS, LTD., South Bersted Industrial Estate, Bognor Regis, Sussex, for applications where heating rates up to  $3^\circ\text{C/sec}$  have to be determined in the range  $-100^\circ\text{C}$  to  $+250^\circ\text{C}$ . Temperatures up to  $600^\circ\text{C}$  can be catered for if required. An efficient heat transfer is provided between the surface to be monitored and the platinum wire element. This element is completely strain-free, shielded to eliminate errors caused by radiation, sealed against ingress of moisture and robust to withstand hazardous operating conditions. The sensor gives a high e.m.f. output per unit temperature change. At  $0^\circ\text{C}$  its resistance is  $100 \Omega$ , and with a typical current of  $2.5 \text{ mA}$  it produces

an open circuit e.m.f. change of the order of  $100 \text{ mV}/^\circ\text{C}$  rise or fall. The time of response to a unit change in temperature is less than 0.35 sec. Mounted on a 0.007in thick metal plate, the sensor can be seam-welded, pop-riveted, soldered or cemented to the required surface.

### STRAIN GAUGE AND THERMOCOUPLE AMPLIFIER

The type A.3 amplifier now made by FENLOW ELECTRONICS, LTD., Springfield Lane, Weybridge, Surrey, is designed to amplify signals from thermocouples and strain gauges in applications where the signal available is very small. The amplifier contains an auxiliary drift correction channel

with the chopping transistor and other components housed in a block temperature-stabilised at  $60^\circ\text{C}$ . The d.c. gain of the amplifier is in excess of  $2 \times 10^6$ , reduced by external feedback resistors in normal use. The amplifier has a bandwidth of  $1 \text{ kc/s}$ , and noise referred to the input is  $5 \mu\text{V}$ . The input impedance is approximately  $2 \text{ k}\Omega$ ; for strain gauge use this is swamped by external resistors. Drift referred to the input after an initial warming up period is less than  $5 \mu\text{V}$ .

The power supply requirements are  $\pm 15 \text{ V}$  and the output swing is  $\pm 9 \text{ V}$  into a  $1 \text{ k}\Omega$  load. The current requirements are  $300 \text{ mA}$  falling to  $80 \text{ mA}$  on the negative supply when the temperature-controlled block reaches  $60^\circ\text{C}$ , and  $80 \text{ mA}$  on the positive supply.

## CATALOGUES AND LISTS

**ALUMINIUM CONDUCTORS.**—Three catalogues in English dealing with aluminium for overhead transmission and distribution lines, and "Solidal" cable.—**Alcan S.A.**, Case Postale, Bärengasse 25, Zürich 22, Switzerland.

**BOILER CONTROL.**—Brochure dealing with automatic electrical control equipment for shell and small water tube type boilers.—**James Gordon & Co., Ltd.**, Dalston Gardens, Stanmore, Middlesex.

**CONTROL EQUIPMENT.**—Data sheet giving particulars of a range of industrial flame failure and burner control units.—**Elcontrol, Ltd.**, Wilbury Way, Hitchin, Herts.

**DEAF AIDS.**—Pamphlet on a new magnetic induction system for use by the deaf in churches.—**OssiCade, Ltd.**, 22-24, Kensington Church Street, Kensington, London, W.8.

**DOMESTIC APPLIANCES.**—Catalogue illustrated in colour and covering the company's range of electric heating appliances and electric blankets.—**Morphv-Richards, Ltd.**, 50, Conduit Street, London, W.1.

Illustrated leaflet covering domestic heating appliances.—**Remploy, Ltd.**, 415, Edgware Road, London, N.W.2.

**ELECTRONIC COMPONENTS.**—Catalogue (202) containing 172 pages devoted to the company's range of switches, signal fittings, connectors, fuses and other electronic components.—**A. F. Bulgin & Co., Ltd.**, Bye-Pass Road, Barking, Essex.

**FURNACES.**—Brochure (R.37) dealing with "Efco-Lindberg" cyclone furnaces for tempering, annealing, hardening, stress relieving, etc.—**Efco Furnaces, Ltd.**, Queens Road, Weybridge, Surrey.

**HORTICULTURAL EQUIPMENT.**—Series of leaflets covering the range of electrical equipment produced by the company for horticultural use.—**Simplex Dairy Equipment Co., Ltd.**, Sawston, Cambridge.

**INSTRUMENTS.**—Data sheets dealing with a range of Siemens & Halske precision laboratory type instruments which are available in the United Kingdom.—**R. H. Cole (Overseas), Ltd.**, 2, Caxton Street, Westminster, London, S.W.1.

Illustrated brochure on a new contemporary series of panel instruments with clear fronts and cover inserts in various colours.—**Sangamo Weston, Ltd.**, Enfield, Middlesex.

Leaflets on the "Moorlite" dustproof, vapourproof and hoseproof fluorescent fitting and a lighting trunking system.—**E. J. Schofield & Co., Ltd.**, 61, Bridge Street, Manchester, 3.

**MOTORS.**—Leaflet (SL.2) giving particulars and dimensions of the "Crypto-D"

range of totally enclosed fan cooled squirrel cage motors.—**Lancashire Dynamo & Crypto, Ltd.**, Acton Lane, Willesden, London, N.W.10.

**PHOTOELECTRIC EQUIPMENT.**—Illustrated brochure describing a range of photo-electronic equipment for industrial use, including a smoke density indicator and alarm, burglar alarms, automatic lighting control, counting units, etc.—**Photoelectronics (M.O.M.), Ltd.**, Oldfields Trading Estate, Sutton, Surrey.

Illustrated brochure dealing with photo-electric control equipment produced by the company.—**Radiovisor Parent, Ltd.**, Stanhope Works, High Path, London, S.W.19.

**RESISTANCE - NETWORK ANALOGUE.**—Leaflet (115) describing a resistance-network analogue designed as a laboratory version of equipment used in the examination of potential field problems.—**Bruce Peebles & Co., Ltd.**, East Pilton, Edinburgh, 5.

**RIVETING MACHINE.**—Leaflet dealing with an electronically controlled precision riveting machine manufactured by Kumag AG., of Switzerland and available from the British agents.—**R. H. Cole (Overseas), Ltd.**, 2, Caxton Street, Westminster, London, S.W.1.

**SPACE HEATING.**—Brochure on the Aerialite electric warm air central heating system for domestic premises.—**Aerialite, Ltd.**, Castle Works, Stalybridge, Cheshire.

Catalogue (40 pages) with a separate price list giving particulars of the "Ekco" range of domestic and industrial space heating appliances, electric blankets, clothes airers, etc.—**Ekco Heating & Electrical, Ltd.**, 41/47, Old Street, London, E.C.1.

**TERMINALS.**—Catalogue issued by H. Knümann & Co., of Essen, containing details of their Phoenix "Quick Fix" terminals in ratings of 20 to 300 A. The text is in five languages and the catalogue is available from the sole British agents.—**D. J. Equipment (Hersham), Ltd.**, 43, Queens Road, Hersham, Walton-on-Thames, Surrey.

**WIRING ACCESSORIES.**—Catalogue (92 pages) containing particulars, prices and coloured illustrations of the company's range of wiring accessories and a booklet (258) entitled "Better Electrical Living with M.K." which gives information about adequate wiring and illustrations of typical accessories available for domestic installations.—**M.K. Electric, Ltd.**, Shrubbery Road, London, N.9.

**X-RAY ANALYSER.**—Booklet (32 pages) giving information on the "Microscan" X-ray analyser.—**Cambridge Instrument Co., Ltd.**, 13, Grosvenor Place, London, S.W.1.

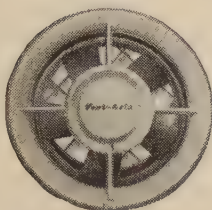


# FOR BETTER AIR CONDITIONS

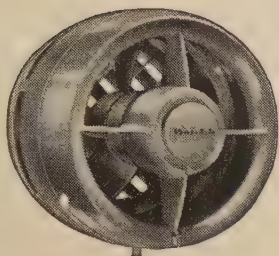
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*in black or ivory*

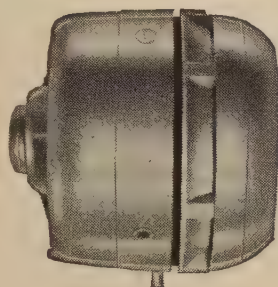
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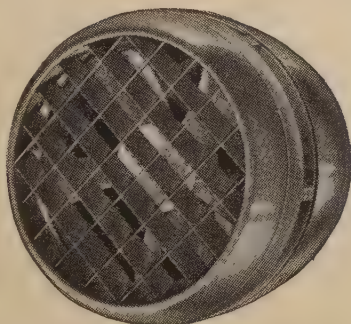
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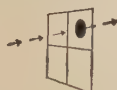
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*Here is ventilation, just as you want it, at the turn of a switch.*

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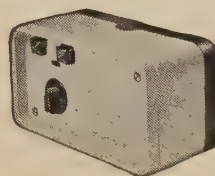
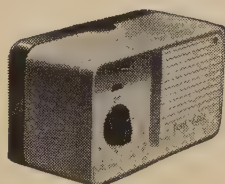
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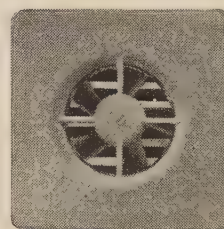


CONTROL SWITCH  
TYPE SD

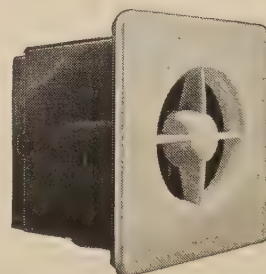
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*with ivory fascia*

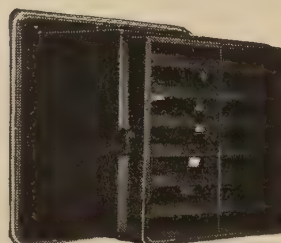
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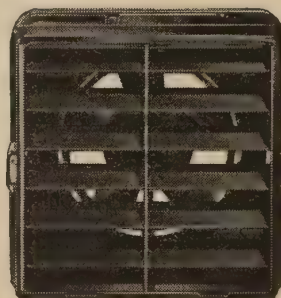
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It will secure the immediate isolation of any electric tool fed from it if the earth leads to the tool casing become defective.

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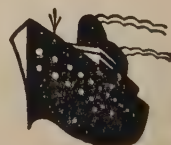
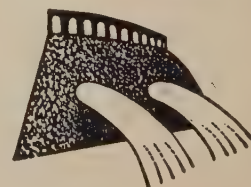
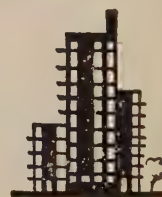
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# BUILDING EXHIBITION

**ALTHOUGH** the number of actual electrical firms exhibiting at the Building Exhibition, now being held at Olympia, London, is not large, there is much evidence of the close co-operation which exists between the electrical and building industries. One of the main attractions at the exhibition is the display of wood-working machinery. Timber is still a main component of building and the highly complex equipment needed for the fast and efficient working of this material, and the way in which electricity speeds up the various operations, is well demonstrated in this section. This year, for the first time, a complete suction plant to take away sawdust, wood waste, etc., services the machinery stands, and the equipment, made and installed by Dallow Lambert, Ltd., provides a striking practical demonstration of its versatility. Collected refuse is discharged into a "Typhoon," one of the company's latest separators for sawmills. Dust and chippings at the bottom of the separator are collected by two-way bagging equipment. Clean air is returned into the exhibition hall, an improvement made possible by two different types of fabric filter which form the other part of the separator.

The stand of the Electrical Development Association is designed to show architects, builders and all concerned with buildings and property the way in which to plan for electric living. With the all-electric kitchen, and the generally accepted number of electrical appliances, adequate wiring is a necessity. According to a graphic display on the stand, 40 to 50 outlets are required in a three-bedroomed house. The latest techniques in electric under-floor heating are shown, with examples of existing installations and running costs. Block storage heaters are also featured. There is an electric water heating display and in the kitchen section four models of split-level cooking units are shown.

In another section power tools for the building industry are displayed, among which is a recently-introduced percussion drill which is claimed to take only one minute to drill a  $\frac{3}{8}$ in hole, 1in deep in hard granite. The Association has also co-operated with the organisers in presenting a "Design for the Disabled" feature. In this, the part that electricity can play in helping handicapped people to lead normal lives in the home is demonstrated.

The heating and ventilating section of the exhibition provides many examples of the various methods of home heating. Eswa, Ltd., are exhibiting what is claimed to be an advanced technique in electrical space heating, based on low-temperature radiation from the ceiling. The source of heating is installed immediately behind the ceiling face and the distinctive feature of the system, developed



Mr. G. D. Metcalfe, Electrical Development Association (left) showing a Moffat built-in cooker unit to Dr. Charles Hill on the Association's stand at the Building Exhibition

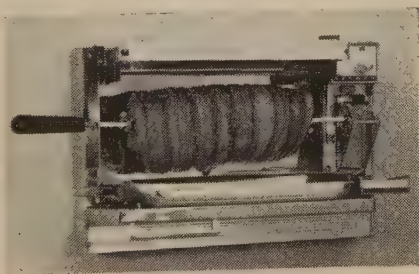
in Norway, is the even distribution of heat at low temperature (85-90°F) over wide areas. It is thermostatically controlled and is particularly suitable for all new buildings.

British Insulated Callender's Cables, Ltd., emphasise the "Panelec" rewirable floor-warming systems. Other heating cable applications displayed by the company include those for anti-frost equipment, quick-release gaskets for cold store doors, horticultural heating methods and pipe tracing for oil and water pipes.

The "Safeheat" electric panel heaters displayed by Wright Electric Motors (Halifax), Ltd., are suitable for wall-mounted electric space heating in offices, schools, hospitals, etc., as well as the home. They are available in six different sizes ranging from 500 W to 1,500 W and the panel casings are finished in stoved enamel. Among the space heating equipment shown by Ekco Heating & Electrical, Ltd., are several models which are being shown for the first time at this exhibition. These include domestic industrial storage heaters, coal and log effect fires, fan heaters, inset convectors and industrial infra-red heaters. The new range of Ekco "Thermostor" storage heaters includes a domestic model, attractively styled and finished in two-tone enamel. A built-in energy regulator controls an adjustable loading of 1,000 to 2,500 W, while a thermal cut-out surrounding the case disconnects the supply in the event of excessive temperature developing because of prolonged charging time.

The General Electric Co., Ltd., is showing a range of "Nightstor" thermal storage heaters with loadings from 1 to 3 kW. Also of interest on the G.E.C.'s stand is the recently introduced "Californian" air conditioning unit. Both air-cooled and water-cooled models are available and the thermostatically controlled heating element have a loading of 2 kW. The G.E.C. also has on view a range of duct-air heaters designed for industrial heating applications involving the use of trunking, either as the primary heat source or for boosting purposes.

A heating system which offers flexibility in the widest sense, embracing both control and application, is the Sterling "Axiatherm" central heating system. Not only



The Cannon "Fold-away" open roasting spit and grill can be fitted to a cabinet top or fixed on the wall



may this system be easily installed in new property but it is also a simple matter to put it into existing houses. It can comprise any number of space heaters, each being thermostatically controlled, wired to one control unit. This control unit incorporates a two-circuit time clock, allowing different time cycles for various rooms and each circuit can be switched on and off up to three times in 24 hours.

Heatrae, Ltd., are showing their latest range of decentralised "Sleekline" panels whose design permits background heating to be installed in new buildings, or added to existing buildings, without disturbance of decorations.

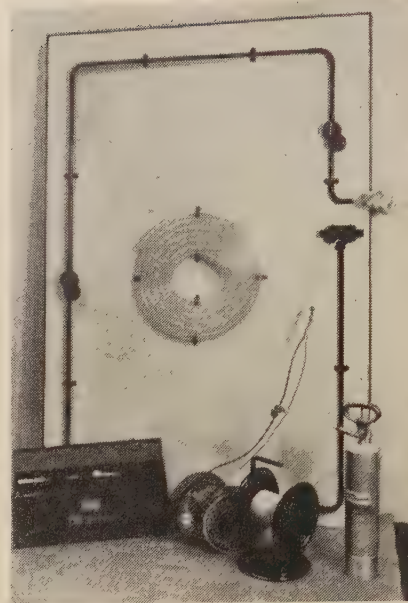
Examples from the wide range of "Dimplex" electric heating appliances for the home, as well as for commerce and industry, are shown. These include oil-filled electric radiators, infra-red fires, towel rails, skirting board convector heaters and industrial overhead heaters.

Forced warm air circulators incorporating centrifugal fan units are shown for the first time by Fenton Byrn & Co., Ltd. These new narrow convectors measure only 8in wide and each unit is fitted with an adjustable thermostat. To ensure quietness in operation the upper section of the heating casing is lined with a sound absorbing material.

The Key Engineering Co., Ltd., manufacturers of pitch fibre pipes, display a pipe flexing machine showing the resilience of the pipe by subjecting a standard length to continuous reversing. Other displays cover the application of "Key" pipe for electrical cable conduit and under-floor duct systems.

On the stand of Explosive Power Tools, Ltd., can be seen the "Rapid-Dusenmax Jetline" which enables electric and other cables to be pulled through a continuous run of conduit up to 300ft in length. The equipment comprises a cylinder of gas connected to a conical washer at the end of  $\frac{1}{2}$ in,  $\frac{3}{4}$ in or 1in diameter conduit. A bobbin containing high tensile strength nylon line is inserted into the end of the conduit with a short length left protruding from the end. The conical washer is inserted, which seals the conduit and at the same time traps the nylon line. A small amount of the gas is released and forces the bobbin through the conduit trailing the nylon line behind it.

A new suspended ceiling lighting system which does



The Rapid-Dusenmax "Jetline" equipment enables cables to be pulled through continuous lengths of conduit up to 300ft in length (Explosive Power Tools, Ltd.)

fittings or by luminous panels. Furthermore, services such as ventilation ducts or public announcement systems can be installed anywhere in the ceiling.

Emphasis on the Atlas Lighting stand is on new developments in lighting techniques. These include the "Atlantic 2" range of fluorescent fittings for industrial and commercial applications which consists of a universal chassis in single- or twin-tube versions, and in 2, 4, 5 and 8ft sizes. Atlas also show a new individual trunking system and a lightweight trunking system for commercial uses.

Falk, Stadelmann & Co., Ltd., concentrate their display on various hospital lighting fittings and exhibits include an all-metal louvred ceiling fitting and matching pendants for general ward lighting, recessed ceiling fittings, fitted with an emergency light, and general lighting for operating theatres.

Isora Illuminating Ceilings, Ltd., show for the first time the "Thermalucent" ceiling. This new ceiling consists of double-layered translucent panels mounted in a supporting grid. The ceiling, it is claimed, not only solves the problem of accumulated dirt being visible on the panels but also offers up to 70 per cent reduction in heat flow.

Only one or two firms are showing items of domestic electrical equipment. One of these, Electrolux, Ltd., has on view a wide range of refrigerators suitable for building in. On view for the first time is the Electrolux M.40, available for sale only to builders and local authorities. It has a shelf area of  $6\frac{3}{4}$  sq ft and a capacity of 4 cu ft.

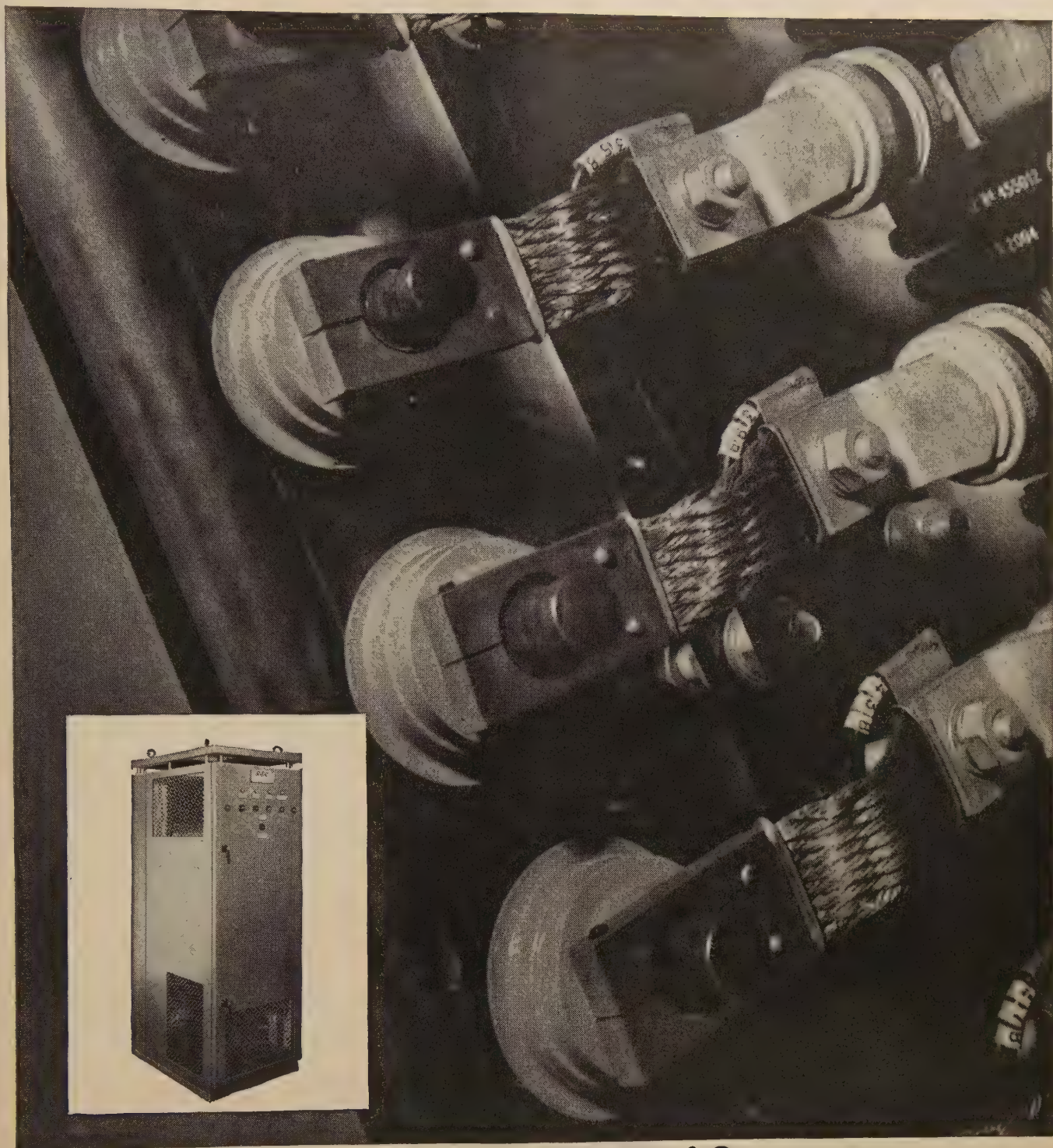
An electric open roasting spit and grill of unusual design is to be seen on Cannon's stand. Known as the "Foldaway," it can either be fixed on any cabinet top or fitted to the wall, and also, provided with feet, used anywhere in the kitchen in a free standing position. When not in use it can, as its name implies, be folded away into a space only  $4\frac{1}{2}$ in deep.

Carron Company take the opportunity to show their latest electric cooker, the "Charmer." This new cooker, fitted with two radiant hotplates ( $6\frac{1}{4}$  and 8in) and grill boiler, is auto-timer controlled.



The Electrolux model M.40 4 cu ft refrigerator is designed as a built-in model





For silicon power rectifier  
equipments, standard or special  
rely on the experience of **G.E.C.**

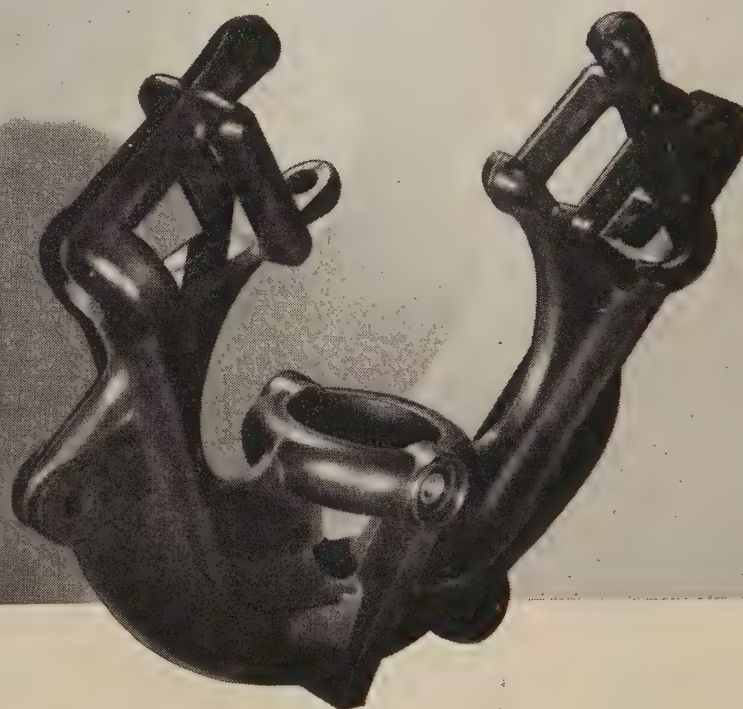
Besides the standard range of equipment, G.E.C. produces special designs for particular applications.

G.E.C. (ENGINEERING) LIMITED, RECTIFIER AND ELECTRONICS DIVISION, BIRMINGHAM 6.



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# Engineering Materials and Design

**A**BOUT 100 firms and organisations were represented at the second Engineering Materials and Design Exhibition held at Earls Court, London, last week. On view was a comprehensive display of engineering components and materials and new design ideas and techniques. Prominent among the exhibits of interest to the electrical industry was a range of "Crystolon" high-temperature electric furnace heating elements manufactured by Norton International Inc., of Massachusetts, U.S.A., and shown by Morganite Electroheat, Ltd., who have recently been appointed sole distributors in the United Kingdom for these products. These elements, which are suitable for operation at temperatures up to  $1,700^{\circ}\text{C}$ , each have a recrystallised silicon carbide matrix impregnated with molybdenum disilicide in the hot zone. The elements have a positive resistance temperature characteristic up to about  $800^{\circ}\text{C}$ , due to the molybdenum disilicide which is metallic in nature. Above this temperature, the influence of the silicon carbide causes the resistance curve to become negative up to about  $1,200^{\circ}\text{C}$  when it returns to positive throughout the rest of the normal operating temperature range. The maximum power loading varies from 90 to 10 W/sq in for furnace temperatures between 1,200 and  $1,680^{\circ}\text{C}$ . The longest operating life is obtained with loadings between 20 and 40 W/sq in. Elements are available with diameters from  $\frac{1}{2}$  to 1 in and effective heating lengths from 5 to 24 in.

A continuous demonstration of low-temperature silver brazing, as used in mass-producing assemblies, was arranged by Johnson, Matthey & Co., who also exhibited Mallory resistance welding electrode materials, including a new series of spot-welding electrodes produced from  $\frac{1}{2}$  in diameter bar. Among the Ferranti, Ltd., exhibits was a series of busbar clamps cast in "NODUMAG," a non-magnetic high-strength ductile material, the physical properties of which include a tensile strength of 24-28 tons/sq in, a yield point of 18-22 tons/sq in and elongation of 8-12 per cent. The clamps are shell moulded and are supplied with a coating of a damp-resisting varnish and with the clamping face surface ground. They are available for flat busbars from 2 to 8 in wide.

A number of exhibits on the British Resins Products, Ltd.'s stand illustrated the use of "Rockite" polyester dough moulding compound—a shock-resistant thermo-setting material reinforced with glass fibre or sisal. These included lightning arrestors made by E.M.P. Electric, Ltd., employing a cap of this material; Vent-Axia, Ltd., wall-mounted fans with outer casings moulded from this compound by Ekco Plastics, Ltd.; and a new Wolf solder gun with a hollow handle moulded in two halves by Minerva Mouldings, Ltd. Applications of "Rockite" phenolic extrusions in busbar trunking were also shown, in addition to a coaxial cable for relaying television programmes. The cable core was sheathed in cellular "Rigidex" high-density polyethylene having a dielectric constant of 1.45.

Other exhibitors showing products for the electrical industry included Engelhard Industries, Ltd., featuring materials for electrical contacts and electro-deposition processes; the International Nickel Co. (Mond), Ltd., displaying nickel and its alloys used for electro-plating,

permanent magnets, and nickel cadmium batteries; Lodge Plugs, Ltd., exhibiting "Sintox" alumina-based ceramic material used as an electrical insulant and in a special form having a low neutron capture cross-section for nuclear reactors; Telcon Metals, Ltd., with a wide range of magnetic materials in nickel-iron and cobalt-vanadium-iron alloys; and Henry Wiggin & Co., Ltd., showing nickel alloys and electric-resistant materials.

A demonstration of spark machining fine slots in a rotor forming the main component of a neutron chopper installed at one of the neutron beam ports of the Herald reactor at Aldermaston was given by the United Kingdom Atomic Energy Authority. This rotor, which weighs 150 lb, is hung when in use from a  $\frac{3}{16}$  in diameter steel shaft and revolves at up to 15,000 r.p.m. The assembly consists of a 3 in diameter core in a 6 in diameter ring, both made from uranium 238, surrounded by a 2 in thick ring of "Duranickel." The total diameter of the assembly is 10 in. Two groups of seven slots are cut diametrically through the unit at right-angles to each other. Since component fabrication was undesirable due to the high rotor speeds and slot production by any orthodox machining method was impossible, a spark erosion technique was adopted. Because of the large depth/width ratio of the slot, guided plate electrodes warped under working conditions and use had to be made of a moving copper wire electrode. A pilot hole was eroded at the end of each slot length, of a diameter within the slot width tolerance, and the wire was fed through this hole and traversed through suitable guides to produce a parallel slot to the required depth.

Also shown on the U.K.A.E.A. stand were high-voltage isolation transformers developed for use in pressure vessels where oil-filled components cannot be used. The insulation and terminal bushing are a one-piece casting in filled epoxy resin to minimise size and the possibility of insulation breakdown. The transformers operate with the core and frame at secondary potential, using standard "C" cores and open type construction. Since standard resin cast primary windings can be used, transformers up to 1 kVA can be manufactured at Harwell in two days.

## Conference on Recent Developments

Held concurrently with the exhibition was a conference at which 22 lectures were given describing developments which have arisen from recent research into a varied range of materials and their applications. The opening address was given by Sir William Penny, deputy chairman of the U.K.A.E.A. Recent developments in insulating materials were described by Mr. J. Wainwright, of the English Electric Co., Ltd., who discussed epoxy and polyester resins for bonds, adhesives and castings, silicon elastomers, integrated mica materials, varnished fabrics, enamelled wires, impregnating varnishes and plastics film. Another paper of electrical interest was given by Mr. J. E. Gould, of the Permanent Magnet Association, who considered the design of permanent magnet systems and the properties of the most widely-used materials. He went on to describe developments with ceramic-like magnets and other permanent magnet materials.



## Financial Section

# STOCKS and SHARES

INDUSTRIAL markets of the Stock Exchange derived support from a hopeful interpretation of recent statements by the Chancellor of the Exchequer which seemed to have a bearing on the future of the credit squeeze and the wages pause. Initiative was, however, appropriately restrained by his continued insistence upon a much better export performance as a necessary prelude to relaxation, and by perplexity over the implications of the pay award to the electricity supply workers. Government stocks failed to improve further upon their previous recovery and some observers detected evidence of a little more activity on the part of trustees in switching from the gilt-edged to the industrial market.

### Higher Prices

There was not a great deal of steam behind the recovery movement in industrial stocks, but a number of popular electrical shares were showing quite substantial gains by the beginning of this week. Shares of the major groups did little more than consolidate the previous week's advances, but elsewhere there were gains of two to three shillings or more in Decca "A" at 66s, E.M.I. at 42s, Berry's Electric at 63s 9d, Ever Ready at 40s 9d (their best price of the year), Thorn Electrical at 60s, Radiation at 25s and W. H. Sanders at 20s. J. Lucas and S. Smith improved a little further upon the gains which had followed publication of the companies' annual results. Tube investments reacted to 65s, although Sir Ivan Stedeford's statement on the outlook for the group made a favourable impression in many respects.

### Mixed Changes

Having continued to climb while most other shares were on the decline, Dimplex perversely fell 4s to 51s during a week when the general trend was upwards. They were kept company by Philips Lamps, which reacted sharply to evidence in the quarterly figures that contracting profit margins are by no means peculiar to this country. Plessey however again moved up strongly, to 44s 3d, and there was a big demand for the company's new convertible loan stock up to 106½. Elliott-Automation at 37s 6d and I.C.T. at 96s 3d benefited

from a spread of the idea that advantages would follow from the introduction of decimal coinage, and Duport were better at 11s 6d despite the report of lower profits: the dividend is in effect unchanged. Sharp rises in Strand

Electric and A. H. Hunt attracted attention elsewhere.

### B.E.I. Outlook

There has been a marked improvement in the 5s shares of British Elec-

## Price Changes in

Company or Board	Nom. Value	Middle price 20th Nov.	Week's Rise or Fall	Dividend		Yield %	1961	
				Pre-vious	Last		High-est	Low-est
Gilt-edged Stocks								
Brit. Elec. 1968/73	100	75½		3	3	£ 3 19 6	75½	70½
Brit. Elec. 1974/77	100	69½	—½	3	3	4 6 3	70½	64½
Brit. Elec. 1976/79	100	71		3½	3½	4 18 6	73½	67
Brit. Elec. 1974/79	100	79½	—½	4½	4½	5 7 0	82	75
Brit. Elec. 1967/69	100	91½	—½	4½	4½	4 18 3	92	86
Overseas Electric Supply								
Calcutta Elec.	£1	21/3		7†	7½†	11 11 0	22/3	20/6
East African Power	£1	12/6	—6d	8	10	16 0 0	15/-	12/6
Nigerian Elec.	£1	18/6	—6d	10	14	15 2 9	19/9	15/6
Perak Hydro-Elec.	£1	20/6		15	15	14 12 9	23/6	17/6
Electrical Shares								
Aberdare Holdings	5/-	18/3	+1/-	17½	17½	—	18/3	14/3
Aerialite	1/-	4/6		54	40	8 18 0	8/-	4/3
Allen, W. H.	£1	25/-		14	10*	8 0 0	42/6	25/-
Allied Insulators	5/-	8/3		20	10*	6 1 3	10/-	8/-
Alwyn Holdings	5/-	21/9		12½	15*	3 9 0	22/3	16/6
Anglo-Portuguese Tel.	£1	19/6	—6d	9	9	9 4 9	25/-	18/9
Arcoelectric	1/-	5/6	+3d	15	15	2 14 6	6/-	3/9
Astaron Electronics	5/-	26/3	+2/9	15	15	—	30/-	17/-
Assoc. Elec. Ind.	£1	34/-		15	15	8 16 6	48/6	28/9
Babcock & Wilcox	£1	22/6	+9d	9	9	—	36/6	19/-
Bakelite	10/-	42/6	—2/9	17½	17½*	4 2 3	60/-	42/-
Baldwin, H. J.	2/-	1/-		10	Nil	—	1/9	1/-
Berry's Electric	5/-	63/9	+3/9	30	33½*	2 12 3	63/9	37/-
Bowthorpe Holdings	2/-	7/6		18½	22	5 17 6	10/3	7/6
Brit. Elec. Resistance	2/-	7/3	+3d	17½	17½*	4 16 6	8/9	6/6
Brit. Elec. Traction:								
Def. Ord. "A"	5/-	53/9	+1/3	40	50	4 13 0	57/6	41/9
British Electronic Ind.	5/-	11/9	+1/-	—	15	6 7 9	15/3	8/9
B.I. Callender's	£1	58/9	+6d	13½	13½	4 11 9	62/3	49/6
B.I. Callender's 6% Pref.	£1	17/-		6	6	7 1 3	18/3	16/6
British Thermostat	5/-	33/9	+2/-	20	27½	4 1 6	40/-	28/-
Brook Motors	10/-	51/9	+1/3	25	25*	4 16 6	55/-	47/-
Bruce Peebles	10/-	16/-		10	Nil	—	21/-	13/3
Bulgin, A. F.	1/-	12/3		55	40*	3 5 3	13/3	7/9
Bulpitts	5/-	16/-		15	16½	5 1 6	27/6	16/-
Burco Dean	5/-	6/-	—6d	18	15	—	11/9	6/-
Cable & Wireless	5/-	17/3	+3d	10	10*†	2 18 0	19/9	12/6
Cambridge Instruments	5/-	30/-	—1/-	12½†	22	3 13 3	38/6	30/-
Chloride El. Storage "A"	£1	73/9	+1/3	17½	20	5 8 6	91/-	72/-
Clarke Chapman	£1	39/-		13½	13½	7 1 0	54/-	37/6
Clarke, T.	2/-	4/-		16	16	5 6 9*	5/3	3/6
Combined Elec. Mfrs.	4/-	7/-		—	12½	7 2 9	10/-	6/9
Contacto Switchgear	5/-	14/3		14	14	4 18 3	16/-	12/6
Crabtree	10/-	25/6	+9d	12½	12½	4 18 0	33/9	23/-
Crompton Parkinson	5/-	12/9	—6d	12½	12½	4 18 0	14/6	11/3
De La Rue	10/-	58/9	+9/3	22½	22½*	3 16 6	70/-	44/6
Decca "A"	10/-	66/-	+3/6	23½	23½	3 9 9	70/-	52/3
Desoutter	5/-	57/6	+2/6	30	35	3 0 9	68/9	49/-
Dewhurst	2/-	5/9	+3d	20	20	3 9 6*	6/6	3/9
Dictograph Tel.	2/-	10/9		20	20	3 14 6	13/-	8/6
Dimplex	5/-	51/-	—4/-	30	35*	2 1 3*	55/6	28/3
Dubilier Condenser	1/-	2/3		30	15*	6 13 3	3/-	2/-
Duport	5/-	11/6	+9d	20	13½*	5 16 0	17/-	10/3
E.M.I.	10/-	42/-	+2/-	17½	17½	4 3 3	51/3	35/3
Eleco	2/-	10/6	+3d	20	20*†	3 16 3	10/6	4/3
Electrical Apparatus	5/-	21/6	+1/6	20	22	5 2 3	21/6	17/-
Electrical Components	5/-	8/9	+3d	11½	12½	7 2 9	9/9	7/9
Elec. Construction	£1	20/3		9	5	4 18 9	39/-	20/-
Elliott-Automation	5/-	37/6	+1/9	9·3	13	1 14 9	37/6	25/6
Enfield Rolling Mills	£1	37/6	+1/6	15	15	8 0 0	51/6	36/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.  
 \* After scrip issue. † Free of income tax. ‡ Dividend indicated.



tronic Industries since Mr. C. O. Stanley's address at the company's annual meeting. He could not say how soon the troubles in the television set industry might be cleared up, or how they might affect profits in the

coming year. Looking further ahead, however, he affirmed that the foundations established in industries outside those fields had such breadth and scope that anything accomplished in the past would be very small in comparison

with what could be done in the future. With this encouragement, the price of the shares has come up since the beginning of the month from 10s 3d to 11s 9d, and the yield of the 15 per cent dividend is now under 6½ per cent.

### Astaron

Under their new name of Astaron Electronics, the 5s shares of the formerly styled Aron Meter company have been in good demand up to 26s 3d. They stood at around 20s before last month's news that Aron's meter business was being sold to Ferranti for £440,000. A statement at that time indicated that the firm's resources were not large enough for development on the major scale necessary to meet the present-day intensity of competition. Meters had been accounting for some two-thirds of output, so that no forecast of profits was possible during the period of re-organisation to increase the production of other forms of equipment. The directors were confident however that the proceeds of the sale could be put to more profitable use than hitherto.

### Crompton Parkinson

Mr. Albert Parkinson's review in Crompton Parkinson's full report had a rather sobering effect upon the 5s shares, but at 12s 9d they remained well above the prices ruling before the preliminary announcement of the improvement of profits during 1960-61. Much of the credit for the company's record achievements went to the consistency of output in almost all of its activities, and the chairman is doubtful whether this condition may be expected to persist in the present year, especially so far as the fields of traction and transformers are concerned. He shares too the general concern over profit margins this year, but taking the long view is in no doubt about the future for the industry as a whole. The shares offer now a yield of a fraction under 5 per cent on the basis of a dividend covered well over twice by earnings.

### Metal Industries Progress

Metal Industries £1 shares moved up to 52s 6d after the issue of the company's interim report on progress during the first half of the year ending next March, and offer now a yield of 5½ per cent on the 15 per cent dividend. Two months ago shareholders were warned that although there was a good volume of orders on hand they were becoming harder to get, and the chairman now reports little subsequent change in that respect. However, profits in the six months under review were rather above last year's comparable figures, and most of the manufacturing subsidiaries are said to be still operating at full pressure.

## Electrical Investments

Company or Board	Nom. Value	Middle price 20th Nov.	Week's Rise or Fall	Dividend		Yield %	1961		
				Pre-vious	Last		High-est	Low-est	
Electrical Shares—continued							£	s	d
English Electric ...	£1	31/3		10	10	6 8 0	40/9	26/3	
English Electric 3½% Pref. ...	£1	10/9		3½	3½	7 0 0	11/9	9/9	
Ever Ready ...	5/-	40/9	+2/3	20	22½	2 15 3	41/-	31/6	
Falk Stadelmann ...	£1	23/6	+6d	7½	8½	7 9 0	26/-	21/9	
G.E.C. ...	£1	28/6	—3d	10	10	7 0 3	39/6	24/3	
G.E.C. 6½% Pref. ...	£1	17/-	+6d	6½	6½	7 13 0	19/3	16/6	
General Cables ...	5/-	4/9		15	Nil	—	6/3	4/9	
G.H.P. Group ...	£1	19/-		6	7½	7 7 3	24/6	17/-	
Goblin (B.V.C.) ...	5/-	4/6		12½	10	11 2 0	8/6	4/3	
Hackbridge Holdings ...	5/-	5/-	—6d	20	10*	10 0 0	6/9	5/-	
Harland Engineering ...	5/-	13/-	+6d	16	16	6 3 0	19/-	12/-	
Head Wrightson ...	5/-	22/6	+2/6	14	16	3 11 0	30/-	20/-	
Heatrae ...	2/-	16/9		12½	25	2 19 9	19/-	12/6	
Holophane ...	5/-	16/9		30	30	8 19 0	20/6	14/6	
Hoover ...	5/-	49/6		90	45*	4 11 0	55/6	37/6	
Hunt, A. H. ...	4/-	19/3	+1/6	20	20	4 3 0	25/9	17/6	
Intl. Combustion ...	5/-	25/6	+1/9	20	30	5 17 9	33/9	22/9	
Intl. Computers & T. ...	£1	96/3	+2/6	10	11½	2 6 9	107/-	59/-	
Johnson & Phillips ...	£1	21/-	—3d	Nil	5	4 15 3	24/-	17/6	
Kenwood Mfg. ...	1/-	3/3		—	—	—	6/-	3/3	
Laurence Scott ...	5/-	15/-		15	15	5 0 0	18/9	14/3	
Lister, R. A. ...	£1	56/3	+1/3	14	14	4 19 6	56/9	45/6	
Lucas, J. ...	£1	57/-	+9d	13½	13½	4 16 6	71/6	50/-	
Marryat & Scott ...	2/-	16/9		27½	32½	3 17 6	18/6	13/9	
Mather & Platt ...	£1	39/6	+2/9	11	11	5 11 0	51/6	36/-	
Metal Industries ...	£1	52/6	+2/6	15	15	5 14 3	66/6	46/3	
Midland Elec. Mfg. ...	£1	56/3	+3/9	12	12	4 5 6	67/6	52/6	
Murex ...	£1	41/-	+1/6	20	13*	6 6 9	51/6	37/6	
Newman Ind. ...	2/-	7/-		12½	15	4 5 9	7/6	5/-	
Oldham & Son ...	1/-	2/6		17½	17½*	7 0 0	3/-	2/3	
Parmiter, Hope & S. ...	1/-	2/-		12½	20	10 0 0	2/5	1/6	
Parsons, C. A. ...	£1	53/9	+1/3	9½	12½	4 13 0	72/6	46/9	
Phillips' Lamps ...	£1.10	200/-	—20/-	16	16*	1 12 0	£13½	£9½	
Plessey ...	10/-	44/3	+1/9	17	15*†	3 7 9	45/-	35/3	
Pullin Group ...	2/-	10/6		25	25	4 15 3	15/-	10/-	
Pyrotex ...	5/-	43/9	+1/9	40	45	3 17 0*	48/9	34/9	
Radiation ...	£1	25/-	+2/6	12	10	8 0 0	37/6	22/6	
Reliance-Clifton ...	5/-	19/6	+1/3	15	20	3 8 3*	22/-	14/9	
Reyrolle ...	£1	43/-	+6d	17½	9½*	4 10 9	51/6	36/6	
Richardsons Westgarth ...	10/-	3/9	+3d	8½	Nil	—	8/3	3/6	
Sanders, W. H. ...	2/-	20/-	+2/6	17½	17½†	1 15 0	28/3	14/-	
Sangamo Weston ...	10/-	25/6		13½	10½*	3 18 6	25/9	18/9	
Scott, James ...	5/-	29/-		25	27½	4 14 9	32/-	25/6	
Simon Engineering ...	5/-	32/9		—	27½	4 4 0	43/9	28/-	
Smith (England), S. ...	4/-	16/-	+3d	20	20	5 0 0	23/9	13/9	
Southern Areas ...	£1	17/-		5	6	7 1 3	23/-	14/6	
Strand Elec. ...	5/-	19/3	+3/-	14*6	20	5 4 0	20/-	12/3	
Sturtevant ...	5/-	9/3		15†	13†	10 18 0	18/6	9/-	
Sun Elec. ...	5/-	16/-		18½	18½	5 15 3	17/6	14/3	
T.C.C. ...	10/-	41/3	+1/3	35	22½*	5 9 0	43/9	40/-	
Telephone Rentals ...	5/-	26/3	+3d	15	15½*	2 17 3	29/6	18/6	
Thompson (John) ...	5/-	12/6	—3d	20	5	—	16/9	12/9	
Thorn Elec. ...	5/-	60/-	+3/6	25	25	2 1 9	63/-	44/6	
Thornycroft ...	4/-	4/3		6	—	—	7/-	4/3	
Tube Investments...	£1	65/-	—2/6	—	14	4 6 3	85/-	54/-	
Ultra Electric ...	5/-	22/-	+2/6	20	25	—	31/3	12/6	
Walsall Conduits ...	4/-	10/6		15	15	5 14 3	15/-	9/9	
Ward & Goldstone ...	5/-	27/-	+1/-	35	17½*	3 4 9	36/6	25/6	
Watford ...	2/-	6/9		25	20*	5 18 6	10/9	6/6	
Westinghouse ...	£1	26/-		11	11	8 9 0	45/-	24/6	
West, Allen ...	5/-	10/3	+3d	12½	13½	6 11 9	14/6	10/-	
Wilkins & Mitchell ...	5/-	8/3		21	12	7 5 6	15/3	8/3	
Wolf Electric ...	5/-	12/9	+3d	12½	13½	5 7 9	17/6	12/6	



## REPORTS and DIVIDENDS

**Crompton Parkinson, Ltd.**—Although outstanding orders are good it is likely that many will have to be executed at profit rates below those experienced during recent years, says Mr. Albert Parkinson, chairman. Demand will not be as great as last year, the directors believe, especially in the traction and transformer fields. The company is said to be keen to retain its character by manufacturing and selling the standard products with which it is familiar and, whenever possible, to grow by expanding existing units.

While the heavier products have faced difficulties this year, other products, including cables and lamps, have shown signs of recovery. Derby Cables, Ltd., has enjoyed a busy year, although there is still insufficient improvement, Mr. Parkinson says, following the recent troubles in the cable industry, and the company's lamp business continues to make steady progress in a difficult market.

Output in the medium range of industrial motors has been considerably increased and there has been a consistent demand over the year, but the present disturbing situation in the domestic appliance field has affected production of fractional horsepower motors. Industrial demand for these motors, however, remains good.

Since the company withdrew from Atomic Power Constructions, Ltd., its future interest in the development of nuclear power will be limited to that of supplying and installing equipment, not the building of nuclear power stations themselves.

Business conditions in Australia, says Mr. Parkinson, have proved to be difficult but in India there was a further improvement by the jointly-owned companies on the success of last year, and the companies in South and Central Africa both showed improved performance. Special efforts are being made to increase exports, Mr. Parkinson says, but "exporting is both difficult and relatively unprofitable and in consequence any step which is taken by the Government to provide practical incentives would do much to relieve the lot of the exporter."

Referring to the Common Market, he says that any move which adversely affects the Commonwealth would be a matter of regret and concern to the company and it is hoped that Commonwealth interests will be accommodated if a closer liaison is made with the "Six." Given equal terms as European manufacturers, he says, the majority of the company's products

should be able to compete satisfactorily with their counterparts manufactured in Europe, for sale either on the Continent or in the home market.

**Metal Industries, Ltd.**, are paying an interim dividend of 6 per cent (the same). Sir Charles Westlake, chairman, in his half-yearly statement, says that results for the six months show a profit of £1,183,000 before tax, but this should not be compared directly with the figure announced at the same time last year since 32 weeks' results were included for some of the companies. By calculating the appropriate proportion of last year's profits, he says, the profit of £1,183,000 for the first six months of this year is an improvement on that of £1,082,000 for the same six months of last year.

Trading conditions, says Sir Charles, have shown little alteration since his statement in September, when he warned that the months ahead were not going to be easy. He goes on to say that most of the manufacturing subsidiaries are still working at full pressure, many of them having plenty of orders in hand, but that new business is proving more difficult to get.

**Tube Investments, Ltd.**—The chairman, Sir Ivan Stedeford, in his annual statement, says that, despite difficulties in the domestic appliance field, the Electrical Division continues to plan for a steadier future, and is concentrating and improving its range of products. Other promising developments are in hand, he says. On the industrial side sales both at home and abroad increased satisfactorily but earnings of the Division were small considering the 7½ per cent sales increase. With the steady improvement in the industrial field and hopes of improved market conditions for domestic appliances, the future promises a more worthwhile contribution from the Division to the results.

Sir Ivan thinks that the Government is pursuing the correct policy in seeking admission to the Common Market, and he says that for some time they have been making plans on the assumption that Britain will join. Some manufacturing companies, if not entire industries, will have to transform themselves or go out of business, when faced with Continental competition.

**Contact Switchgear, Ltd.**—The order book is in good shape, but competition is becoming even more intense and it seems as if this trend is likely to continue, says Mr. H. Rayner, chairman, in his statement for the year

ended 31st July. Output has increased by 27 per cent, he says, and providing the country's economy remains stable the results for the current year should not be drastically different from last year's.

The Electronics Company is not yet on a profit-earning basis owing to the removal to Wolverhampton but Mr. Rayner says an improved trend is already noticeable.

**Senior Economisers, Ltd.**, announce an unchanged interim dividend of 8 per cent and state that further finance will be required in the near future in connection with plans for the expansion of the group's operations. The directors expect group profits for the current year to show a considerable increase over those of the previous year, on the basis of unaudited figures and in the absence of unforeseen circumstances. They add, however, that it must not be assumed that such increased profits can be necessarily maintained.

**Burgess Products Co., Ltd.**, report a net profit of £191,828 for the year ended 31st July last, an increase over the previous year of £46,261. In announcing that the dividend will be maintained at 20 per cent, Mr. E. J. L. Cotton, chairman, says that trading results were a record, with special credit again going to the micro-switch division, where the turnover increased by more than 40 per cent. The current year's order book and sales continue to be satisfactory.

**Colston Increase Capital.**—Sir Charles Colston, chairman of Charles Colston, Ltd., announced on Tuesday that, in order to finance expanding business and open up new markets abroad, the company is increasing its authorised capital to £700,000 and its paid-up capital from £565,000 to £650,000.

Charles Colston, Ltd., together with Rolls Razor, Ltd., have recently formed a joint company, Rolls-Colston Appliances, Ltd., which will be responsible for the manufacture and sale of dishwashers in the United Kingdom.

**Remploy, Ltd.**—Sir Alec Zealley, chairman, in his annual review, announces that sales for the year ended 31st March, 1961, reached a record £5,557,000, an increase of £414,000. The excess of expenditure over income, however, amounted to £2,752,518, some £32,000 more than in 1959-60. Explaining the reasons for this increase he says that more than a hundred extra disabled persons have been employed,

(Continued on page 861)

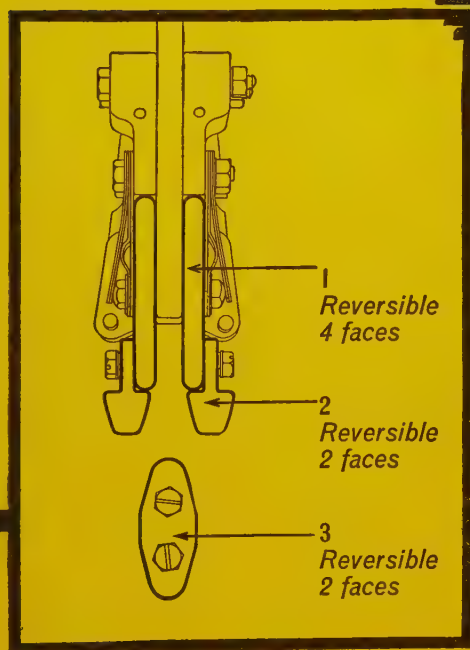


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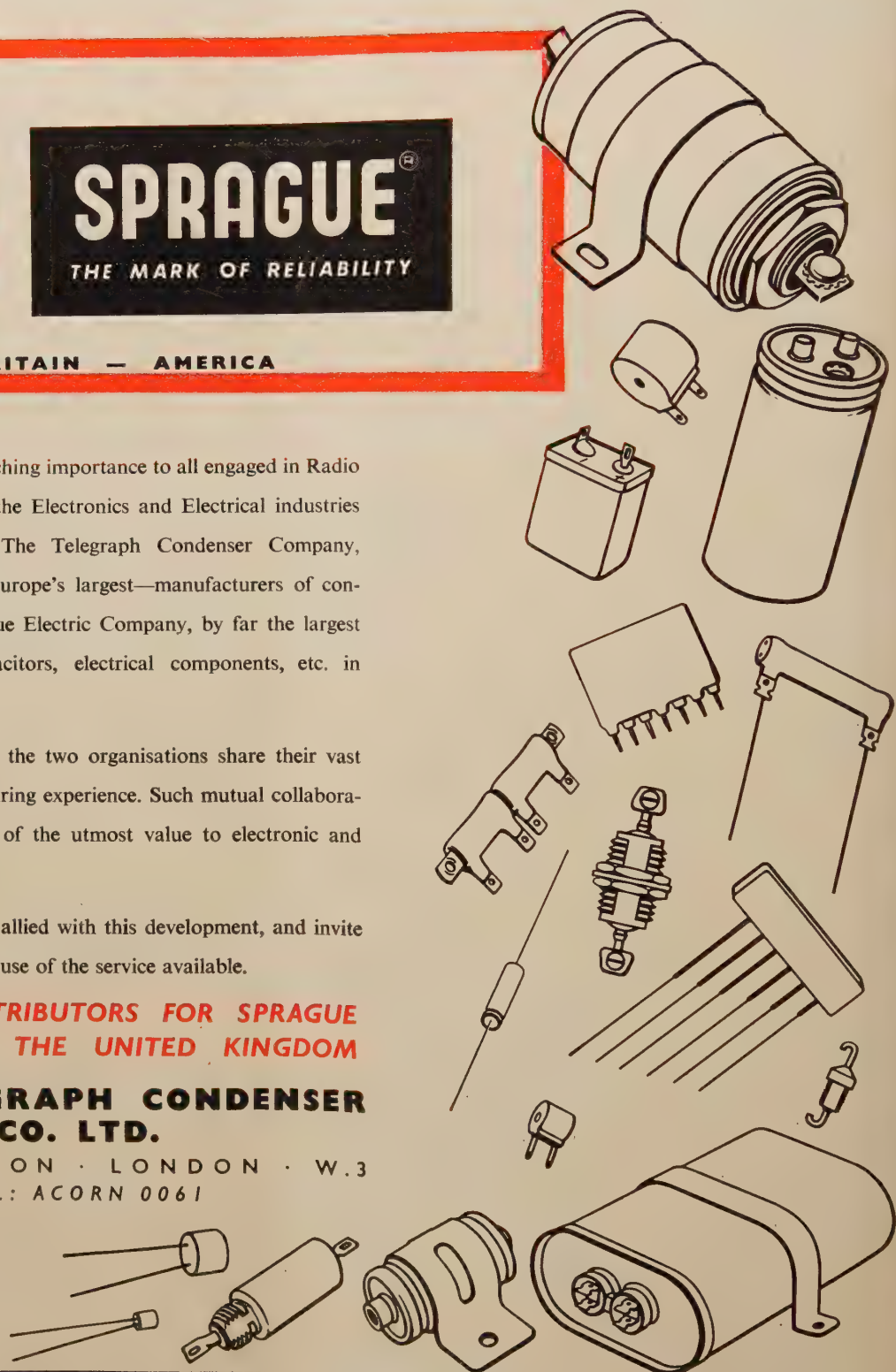
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**FINANCIAL SECTION** (continued)

and increases in salaries and wages have been granted, amounting to £65,000. Trading conditions, he says, have also been difficult this year, since the Government re-imposed hire-purchase restrictions.

**Ward & Goldstone, Ltd.**—Interim dividend 5 per cent (the same).

**New Companies**

**Midland Control Gear, Ltd.**—Registered 27th October. Capital £1,000. Manufacture of electrical, electronic and mechanical control and switchgear, etc. Directors: S. T. Morrow, junr., and S. T. Morrow, senr. Secretary: J. N. McKenzie. Regd. office: 109, Colmore Row, Birmingham.

**Leyford (Electrical), Ltd.**—Registered 30th October. Capital £100. Electrical engineers, etc. Directors: E. Whitelaw and F. H. G. Osborn. Secretary: Mrs. G. N. Whitelaw. Regd. office: 8, Penderley Road, S.E.6.

**Upfold Electrical, Ltd.**—Registered 30th October. Capital £100. Electrical engineers, etc. Directors: W. G. Upfold and R. S. Boater. Secretary: P. J. W. Alexander. Regd. office: 6a, Windsor Street, Chertsey, Surrey.

**South Hampshire Electrical Co., Ltd.**—Registered 25th October. Capital £500. Manufacturers of and dealers in lighting and fluorescent lighting, etc. Subscribers (each with one share): G. E. W. Beaver (first director) and Mrs. R. C. Beaver. Secretary: Rita C. Beaver. Regd. office: Little Timbers, Hall Lands Lane, Fair Oak, Hants.

**P. J. North, Ltd.**—Registered 13th November. Capital £1,000. Manufacturers of and dealers in electrical goods, etc. Directors: P. J. North (secretary) and Barbara North. Regd. office: 23, Filey Street, Sheffield, 10.

**Rand Radiators, Ltd.**—Registered 9th November. Capital £100. Electricians, mechanical and central heating engineers, etc. Directors: S. G. Rand and Gladys I. Wykeham-Edwards. Regd. office: Chancery House, Chancery Lane, W.C.2.

**Research Tools, Ltd.**—Registered 10th November. Capital £100. Electronic and automation engineers, etc. Directors: S. C. Hoare (secretary), Elizabeth E. Hoare and A. C. Hoare. Regd. office: 79, Caterham Avenue, Barking, Essex.

**Diaz Electric (Dunstable), Ltd.**—Registered 27th October. Capital £1,000. Manufacturers of and dealers in electrical and electronic goods, etc. Directors: J. Diaz and J. F. Venner. Secretary: A. L. W. Rich. Regd. office: 201, Great Portland Street, W.1.

**Continental Lighting (Wholesale), Ltd.**—Registered 26th October. Capital £500. Directors: R. N. Morcom and Evelyn S. Morcom. Regd. office: 376, Anlaby Road, Hull.

**R. F. Dill, Ltd.**—Registered 26th October. Capital £100. Manufacturers of and dealers in electrical goods, etc. Directors: R. F. Dill (secretary), and B. Holroyd. Regd. office: 182, Greenhill Road, Leeds, 13.

**Petersfield Electrical Services, Ltd.**—Registered 26th October. Capital £1,000. Electrical engineers, etc. Directors: B. J. Bull and Willards Electrical Services, Ltd. Secretary: T. H. Sherlock. Regd. office: 10, South Pallant, Chichester.

**Stanley R. Woollett, Ltd.**—Registered 1st November. Capital £10,000. Electricians, radio, television and general engineers, etc. Directors: S. R. Woollett and Barbara Cullingford. Secretary: Shirley Hart. Regd. office: 56, Duckworth Lane, Bradford, 9.

**Hillvar, Ltd.**—Registered 3rd November. Capital £100. Electrical, radio, television and general engineers, etc. Secretary: Laurence R. Battell. Regd. office: 13, Well Court, Bow Lane, E.C.4.

**Stirk & Mawson (Bradford), Ltd.**—Registered 3rd November. Capital £5,000. Elec-

trical wholesale distributors, etc. Directors: H. K. Stirk and W. A. Mawson. Secretary: Mrs. Mabel Stirk. Regd. office: Brimcor House, 9, Myrtle Place, Bingley, Yorks.

**Allied Electrical & Plumbing Services, Ltd.**—Registered 3rd November. Capital £1,000. Regd. office: 12, Varley Parade, Edgware Road, The Hyde, N.W.9.

**Delve & Nankervis, Ltd.**—Registered 3rd November. Capital £2,000. To acquire the business of electrical contractors carried on by Delve & Nankervis at Bedford Road, St. Ives, etc. Directors: J. T. Nankervis and A. J. C. L. Delve. Regd. office: Porthmeor Road, St. Ives, Cornwall.

**Bird & Johnson (Electrical Engineers), Ltd.**—Registered 3rd November. Capital £100. Directors: K. W. G. Bird (secretary), and R. Johnson. Regd. office: 10, Frayne Road, Ashton, Bristol, 3.

**Technicon Instruments (Overseas), Ltd.**—Registered 7th November. Capital £100. Mechanical and electrical engineers, manufacturers of and dealers in scientific instruments, etc. Solicitors: E. F. Turner & Sons, 66, Queen Street, E.C.4.

**Barwall (Electrical), Ltd.**—Registered 7th November. Capital £100. Secretary: L. R. Battell. Regd. office: 13, Well Court, Bow Lane, E.C.4.

**Wholesale Industrial Electrical Equipment, Ltd.**—Registered 7th November. Capital £100. Directors: T. F. McEhannan and G. G. Thompson. Secretary: F. F. McEhannan. Regd. office: 61, Boldmere Road, Sutton Coldfield.

**R. W. Beach & Co., Ltd.**—Registered 24th October. Capital £3,000. Manufacturers of and dealers in electric fans, equipment and apparatus, etc. Directors: R. W. Beach (permanent managing director) and Valerie A. Beach (secretary). Regd. office: 179, Bradford Street, Birmingham, 12.

**Electrical Projects Co., Ltd.**—Registered 23rd October. Capital £100. Electrical, radio, electronic and mechanical engineers, etc. Directors: D. Nicholls and Mrs. Muriel Nicholls (secretary). Regd. office: 49, Church Street, Eccles, Lancs.

**A. & E. Electrical (Manchester), Ltd.**—Registered 18th October. Capital £100. Manufacturers of and dealers in electrical goods, etc. Directors: W. Albiston and F. Entwistle. Secretary: Margaret E. Entwistle. Regd. office: 1149, Rochdale Road, Manchester, 9.

**Sondec, Ltd.**—Registered 18th October. Capital £100. Electrical, electronic and civil engineers, etc. Directors: A. V. Olorenshaw (secretary), 1, Little Dover House, Dover Park Drive, S.W.15, and F. E. S. Robinson.

**Willis & Hedges, Ltd.**—Registered 18th October. Capital £1,000. Electrical engineers, etc. Directors: J. J. Willis, Mrs. Mary C. Willis, F. A. Hedges and Mrs. Dorothy M. Hedges (secretary). Regd. office: 76, Church Road, Ashford, Middx.

**Haynes Bros. (Wallingford), Ltd.**—Registered 11th October. Capital £100. To carry on the business of electrical engineers, etc. Directors: K. R. Haynes, Lena M. Haynes, J. C. Haynes and Elsie E. Haynes (secretary). Regd. office: Industrial Estate, Wallingford, Berks.

**A. C. Grubb, Ltd.**—Registered 22nd September. Capital £100. Electrical engineers, engineers and machinists, etc. Directors: A. C. Grubb and Annie B. Grubb. Secretary: T. A. Cotterill. Regd. office: Sun Building, Bennetts Hill, Birmingham, 2.

**Fonhill Electronic Development Co., Ltd.**—Registered 12th October. Capital £100. Directors: A. W. King and W. C. King. Regd. office: 57, Boundary Road, Hove, Sussex.

**All Points Electric Co., Ltd.**—Registered 11th October. Capital £3,000. Electrical contractors, etc. Directors: A. H. Garside and J. K. Klarfeld. Secretary: I. W. Wisely. Regd. office: 2, Reservoir Road, Ruislip, Middx.

**Pearson Valves, Ltd.**—Registered 8th November. Capital £500. Design specialists, distributors of and dealers in valves,

electrically operated valves, control gear, etc. Directors: G. H. Pearson, Mrs. Marjorie Pearson, Miss Mary J. Lawrence (secretary) and Mrs. Margaret Whitson. Regd. office: 52, Bridge Street, Newport, Mon.

**Receiver Appointed**

**Ellison (Transformers), Ltd.**—Mr. R. A. Palmer, 45, Sheep Street, Northampton, was appointed receiver and manager on 23rd October, 1961, under powers contained in debenture dated 5th November, 1958.

**Liquidations**

*Winding-up proceedings or liquidations are often undertaken for the purpose of reconstruction, the transfer of a business, or other reasons. The appearance of a company's name under this heading therefore does not necessarily indicate insolvency.*

**Walter Instruments, Ltd.**, electrical and electronic equipment manufacturers, 28, King Street, London, E.C.2.—Winding up voluntarily. Joint liquidators, Mr. C. E. M. Emmerson, 28, King Street, London, E.C.2, and Mr. H. W. Pitt, 100, Park Street, Grosvenor Square, London, W.1, appointed by members and creditors on 24th October.

**J. W. H. Bethel, Ltd.**, radio and television engineers and electrical contractors, 76, Preston Street, Faversham, Kent.—Winding up voluntarily. Liquidator, Mr. R. A. Hawken, Bank Chambers, 1, John Street, Bedford Row, London, W.C.1, appointed by creditors on 2nd November.

**Leslies Electricals, Ltd.** (Creditors' voluntary winding-up).—Meetings of the company and creditors 15th December at 112, Crescent Road, Reading, to receive an account of the winding-up from the liquidator, Mr. H. Tilbury.

**Matthews & Wright, Ltd.**, radio, television and electrical appliance dealers, 214-218, Westminster Buildings, High Street, Doncaster.—Liquidator, Mr. R. W. Hellyer, Brotherton House, Westgate, Leeds, 1, appointed by creditors on 7th November.

**W. B. Hardman, Ltd.**, television, radio and electrical engineers, 105, Albert Road, Farnworth, near Bolton, Lancs.—Winding up voluntarily. Liquidator, L. H. Shipton, 31, Lloyd Street, Manchester, 2, appointed by members and creditors on 13th November.

**Patonic, Ltd.**, electrical engineers, Rodney Road, Fratton, Portsmouth.—Winding up voluntarily. Liquidator, Mr. J. B. Howse, 15, Cromwell Road, London, S.W.7, appointed by members on 28th October.

**Bankruptcies**

**C. Parker**, lately residing and carrying on business at 4, Newlands Park Road, Scarborough, as a refrigeration and electrical sales and service proprietor.—Public examination 16th January at the Court House, Castle Road, Scarborough.

**L. T. Simpson and P. B. Cannon**, lately carrying on business in partnership under the style of Hayden Sterling at 3a, Lynton Parade, Edgar Road and 14, Northdown Road, Cliftonville, Margate, at 1a, Harbour Buildings, Whitstable and at 3, Minnis Bay Parade, Bournemouth, Kent, electrical dealers.—Public examination 23rd January at the Sessions House, Longport, Canterbury.

**I. M. Swallow**, lately residing and carrying on business at 19, Blyth Hey, Litherland, Liverpool, 21, under the style of Electrical Repairs & Trading Co., electrical contractor.—Public examination 9th January at the Court House, India Buildings, Water Street, Liverpool.

**D. & M. Martin** (a firm), radio and electrical engineers, carrying on business at 13, Rose Cottages and formerly at Meadow Lane, Burton Joyce, Nottingham.—Receiving order made 3rd November on a creditor's petition.

**J. B. English**, electrical engineer, 1, Harrogate Court, Corby, Northampton.—Receiving order made 13th November on debtor's petition.



# INSULATION BREAKDOWN BY TRACKING

By N. PARKMAN, B.Sc.

Summary of a lecture delivered by the author before the Measurement and Control Section of the Institution of Electrical Engineers in London on 14th November

ONE important problem which frequently faces the designer of electrical apparatus is to determine suitable creepage and clearance distances between electrodes at different potentials. If one treats the subject theoretically it is easy to ascertain electrode spacings which will withstand the maximum overvoltage which may arise from a given set of circumstances. Unfortunately, treatments of this sort presuppose that the surfaces of the insulator separating the electrodes remain in a clean condition.

In many service applications an insulator may be contaminated with moisture or electrolytes; with dusts which may be carbonaceous or metallic; with the conducting films which arise from electrical discharges in the ambient medium; or from acidic sludges which are present owing to the ageing of insulating fluids. The contaminants may produce breakdown by electrochemical effects consequent on the passage of leakage currents. In other cases the passage of a leakage current in the surface contaminant may produce sufficient heating of the surface to remove the film of contaminant locally. This sudden introduction of a high resistance into the leakage path produces a sudden drop in current and a corresponding overvoltage at the site of the discontinuity. The overvoltage may then produce electric sparks which degrade the surface of the insulator. The process repeats itself when further contamination causes a leakage current to flow once more. These successive sparks on the surface of the insulator cause progressive damage and if the insulator is organic carbonisation may occur, with the consequent production of a highly conducting path between the electrodes.

In some cases where the material is likely to be aged rapidly as a result of exposure to high ambient temperatures or ultra-violet light, its resistance to the subsequent effects of contamination may be markedly reduced. Thus, while the predominant effect of atmospheric dust is a deleterious one it may exert a small beneficial effect on materials which are sensitive to degradation by ultra-violet light by acting as a filter for the damaging short wavelengths. Failure by tracking has been recognised for many years, but until recently British Specifications have not included any clause which would enforce the utilisation of track-resistant materials in situations where a pronounced tracking hazard existed.

## Chemical Structure

Many factors in the chemical composition of electrical insulating materials affect their resistance to tracking. Chemical structures which have high proportions of carbon track readily if the effect of heating is to split off elemental carbon from the chemical structure. However, some

organic insulators with high carbon content are very track resistant owing to the tendency of these materials to lose mass by volatilisation of hydrocarbon gases. Chlorinated materials do not on the whole have good track resistance because heating these materials evolves chlorine or hydrochlorine acid gas, leaving the rest of the structure sufficiently unstable to carbonise on further heating.

In recent years tests to assess resistance to tracking have become widely accepted. The important variation in the many types of tracking tests which have been put forward is in the nature and method of artificial contamination of insulating surfaces. Contaminants which simulate those likely to arise in service are difficult to reproduce in the laboratory so that the test which has now been accepted internationally uses a somewhat arbitrary electrolyte as its contaminant. This is the International Electrotechnical Commission (I.E.C.) test which uses 0.1 per cent ammonium chloride to contaminate a region between two electrodes resting on the insulator under test. Tests are carried out at different voltages until a voltage is found at which the number of applications of contaminant required to produce tracking on a given material increases sharply. This voltage is called the comparative tracking index (c.t.i.) for that material. Although this voltage cannot be used directly for design purposes it is a useful comparative measure of the material's resistance to tracking. The materials used in electrical engineering have c.t.i.'s in the range 100 V to more than 500 V. It is found that materials with low c.t.i.'s frequently do not gain greatly from increase in electrode spacing while keeping other conditions constant, i.e. the voltage corresponding to the c.t.i. at the standard spacing is not significantly altered by increasing electrode spacings. The voltage to cause tracking in track-resistant materials increases with increase in electrode spacing. Recommendations permitting the use of low track-resistant materials in designs by making small increases in creepage paths are therefore of doubtful validity.

## F.H.P. Motor Dimensions

IN the revised edition of B.S. 2048, "Dimensions of Fractional Horsepower Motors. Part 1: Dimensions of Motors for General Use," the number of frames covered has been increased to five. The dimensions specified are those necessary to ensure that motors of different make, but of the same frame size, will be mechanically interchangeable so far as shaft and mounting dimensions are concerned. With the exception of frame 42 and the flange mountings, the dimensions permit the interchange of frames with those specified in the (American) N.E.M.A. Standard M.G.I.—January, 1959, dealing with general-purpose f.h.p. motors.

The specification applies to single-phase and polyphase a.c. motors and d.c. motors having enclosures of the type permitted by B.S. 170 and with sleeve or ball bearings. The mountings are foot, flange, and resilient base, with or without belt-tensioning devices.

Copies may be obtained from the British Standards Institution, 2, Park Street, London, W.1, price 5s.



## Two-Speed Induction Motors

**F**OLLOWING the invention of a two-speed single-winding induction motor by Professor G. H. Rawcliffe in 1958, the world's largest machine of this type was demonstrated to Central Electricity Generating Board engineers and consulting engineers on 1st November last when they visited the Trafford Park works of Lancashire Dynamo & Crypto, a company in the Metal Industries Group. This 840 h.p. machine has a single stator winding for 8/10 poles. Although no British contracts have yet been received, Lancashire Dynamo & Crypto has produced the first commercial machines which will go to power stations in Eastern Europe. A full technical description of this type of induction motor, which has been developed in collaboration with the National Research Development Corporation and a number of motor manufacturers, was given by the inventor in the *Electrical Review* of 22nd January, 1960.

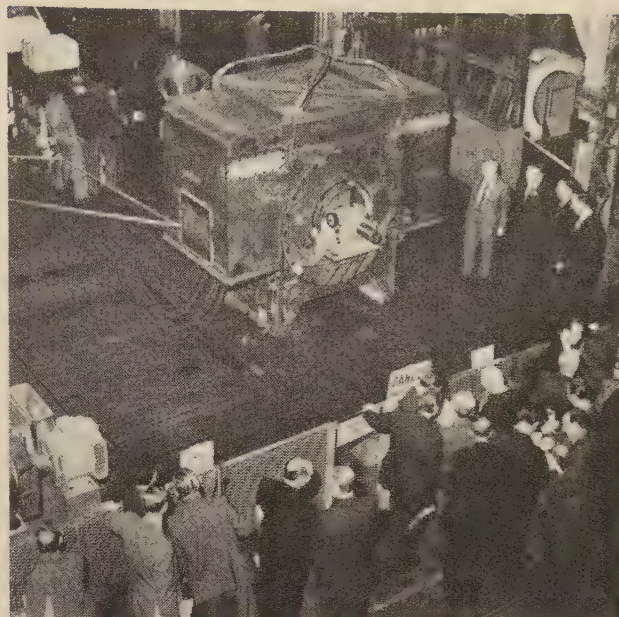
The main advantages of the new motor windings are the reduction in motor size and cost because of the better utilisation of the winding space compared with the motors having two separate stator windings. Other advantages are increased robustness and better high-speed performances. The new single winding uses all the available winding space for both speeds and this lends itself more readily to mechanical supporting and has an increased heat capacity which is important for starting of high inertia loads.

An extensive programme of prototype tests was carried out in which windings, which had been designed from theoretical considerations and had been tried on small machines, were applied to medium-sized machines in the 30 to 100 h.p. range. In addition to all normal tests at both speeds, the noise level was measured on the loaded and unloaded machines and was found quite acceptable. Dynamic speed-torque characteristics were taken on a Duddell oscilloscope and the results indicated that there were no objectionable torque dips at either speed. It was also established that good agreement between design calculations and test results could be obtained.

### Applications

Motors with a speed ratio of 1.5:1 or closer are frequently used for centrifugal fan and pump applications where the load varies as the cube of the speed. They are also occasionally used for constant torque loads, such as conveyors. Connections for both types of load are fully developed for 6/8 and 8/10 pole motors and for multiples of these pole numbers. At present, the limit for these motors has been fixed at a top-speed output of 4,000 b.h.p. The wide-speed windings are likely to prove useful for motors where inching or regenerative braking forms part of the duty.

Typical examples of some L.D.C. pole-amplitude modulated motors in use or under construction are:— (1) Vertical pipe ventilated 17/7.5 b.h.p. 16/20 pole motors at 400 V, 40 c/s, three-phase, driving cooling tower fans at 286/228 r.p.m. In this case, the speed change is accomplished twice annually to suit climatic conditions by changing links in the terminal box. A



An 840 h.p., 8/10 pole, two-speed single-winding squirrel-cage induction motor being demonstrated by Lancashire Dynamo & Crypto, Ltd.

normal, single-speed squirrel-cage starter is used. (2) Totally enclosed "Corcooled" 336/148 b.h.p. 6/8 pole motors at 3,300 V, 50 c/s, three-phase, driving i.d. fans having a  $Wr^2$  of 17,500 lb. ft<sup>2</sup>. The starting current is limited to 4.5 times full-load current at both speeds; (3) ventilated weather-protected 840/450 b.h.p. 8/10 pole motors at 6,000 V, 50 c/s, three-phase supply, driving i.d. fans having a  $Wr^2$  of 100,000 lb. ft<sup>2</sup>.

### Control Gear

The motor speed can be changed by altering links in the motor terminal box or by an off-load change-over switch, so that a conventional single-speed starter can be used for starting and stopping. Where automatic or remote control is required, a three-pole and a five-pole contactor, or an equivalent arrangement is needed.

On large high-voltage motors for power stations with large fault level capacities, circuit-breakers are commonly employed for motor switching. As five-pole circuit-breakers are not usually available, two three-pole and one two-pole breaker may have to be used. This is relatively expensive and could partially cancel out the saving in the motor price. A more economical method of control is the use of two three-pole circuit-breakers with an interlocked, off-load contactor which makes the star point before the motor is connected to the supply by the high-speed circuit-breaker. It opens the star point after the motor has been disconnected from the supply.

As on all two-speed motors, where the number of poles differ by two there must be a time delay to ensure that the first field has died down before the motor is switched on to the second speed. If this precaution were not taken the motor could be damaged by a large transient unbalanced magnetic pull.



# NEW PATENTS

## Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

### 1956

34998. Electroflo Meters Co., Ltd.—Amplifying apparatus. 11th November, 1957. (881515.)

### 1957

1866. Electric & Musical Industries, Ltd.—Phase and frequency control circuits. 20th January, 1958. (881302.)

2496. Charles Colston, Ltd.—Automatic temperature responsive time-control system. 17th January, 1958. (881421.)

### 1959

2988. United Kingdom Atomic Energy Authority.—Liquid-level gauges. 3rd December, 1959. (880978.)

4759. Igranic Electric Co., Ltd.—Electric lamp and like fittings. 11th February, 1959. (880615.)

5431. T.I. (Group Services), Ltd.—Electrical circuit element and its manufacture. 17th February, 1960. (880494.)

6176. General Electric Co., Ltd.—Metal contact elements. 22nd February, 1960. (880447.)

7885. Self-Changing Gears, Ltd.—Electrical control means for transmission gearing. 4th March, 1960. (880619.)

10210. Thorn Electrical Industries, Ltd.—Conversion of sonic into luminous effects. 4th March, 1960. (880817.)

10831. English Electric Co., Ltd.—Railway vehicle braking system. 31st March, 1960. (880834.)

11185. Rank Cintel, Ltd.—Electrical apparatus including printed circuits. 2nd April, 1959. (880448.)

11387. General Railway Signal Co.—Centralised railway traffic control system. 3rd April, 1959. (880634.)

12709. United Kingdom Atomic Energy Authority.—Nuclear reactors. 5th April, 1960. (880489.)

12801. British Insulated Callender's Cables, Ltd.—Terminal boxes for electric cables. 19th April, 1960. (880490.)

12839. De Havilland Aircraft Co., Ltd.—Electrical butt connector. 24th February, 1960. (880451.)

15657. Ultra Electronics, Ltd.—Circuit arrangements for cold-cathode tubes. 26th February, 1960. (880882.)

17112. Electroschaltgeräte Grimma Veb.—Electric cam switches. 20th May, 1959. (880453.)

17230. United Kingdom Atomic Energy Authority.—Electromagnetic pumps. 12th May, 1960. (880454.)

18840. A.E.I. Lamp & Lighting Co., Ltd.—Electrical connections. 1st June, 1960. (880579.)

19147. United Kingdom Atomic Energy Authority.—Nuclear reactor installations. 20th May, 1960. (880455.)

19733. Electric Auto-Lite Co.—Electrical contact breaker assembly for engine ignition systems. 9th June, 1959. (880550.)

20828. Micafil A.G.—Automatic armature winding machines. 17th June, 1959. (880581.)

22724. Dorman & Smith, Ltd.—Construction and mounting of doors on electrical switchboards. 9th June, 1960. (880552.)

24478. General Electric Co., Ltd., and Wells, J. W. R.—Tools for the withdrawal of printed circuit panels from associated connectors, for example electrical socket connectors. 22nd June, 1960. (880987.)

24959. International Business Machines Corporation.—Electric recording circuit. 21st July, 1959. (880772.)

25904. Associated Electrical Industries, Ltd.—Apparatus for making electric valves and the like. 27th July, 1960. (880651.)

26818. Naimer, H. L.—Electromagnetic rotary switching mechanism operable under remote control. 5th August, 1959. (880458.)

28013. Standard Telephones & Cables, Ltd.—Superconducting switching elements. 12th August, 1960. (880459.)

28411. Maschinenfabrik Oerlikon.—Electric cut-outs. 19th August, 1959. (880851.)

28979. Chilton Electric Products, Ltd.—Electrical circuit-breakers. 23rd March, 1960. (880621.)

29011. Cannon Electric Co.—Electrical connector for strip cable. 25th August, 1959. (880585.)

31229. General Electric Co.—Nuclear fuel and rod structure. 14th September, 1959. (880662.)

32391. Babcock & Wilcox, Ltd.—Nuclear reactors. 21st September, 1960. (883501.)

34927. Cole, Ltd., E. K., and Saunders, P. W.—Amplifier circuit arrangements. 21st September, 1960. (883503.)

35693. Elmaco Electrical Manuf. Co. Proprietary, Ltd.—Single or strip electrical connectors. 21st October, 1959. (883450.)

35820. Texas Instruments, Inc.—Semiconductor device. 22nd October, 1959. (880732.)

37227. Arrow Electric Switches, Ltd.—Interlocked trigger and reversing electric switches. 3rd November, 1959. (880733.)

41924. Bendix Corporation.—Transistorised voltage regulator. 9th December, 1959. (883505.)

43351. Textron Electronics, Inc.—Vibration exciter apparatus. 21st December, 1959. (883452.)

### 1960

539. Zimmermann & Jansen G.m.b.H.—Electrically operated stove changing control apparatus for blast furnaces. 6th January, 1960. (883508.)

2355. Allmänna Svenska Elektriska A.B.—Apparatus and method for removing welding bulges on chain links. 22nd January, 1960. (883261.)

4319. Westinghouse Electric Corporation.—Thermal indicators for electrical apparatus. 8th February, 1960. (883374.)

7580. Bernard, M. G. A.—Semiconductor devices. 3rd March, 1960. (883468.)

13674. Maschinenfabrik P. Pfenningsberg G.m.b.H.—Washing machines. 19th April, 1960. (880512.)

14026. Philips Electrical Industries, Ltd.—Mixing circuits for high frequency oscillations. 21st April, 1960. (880541.)

14036. Intermetall Ges. für Metallurgie und Elektronik.—Hermetically sealing semiconductor devices. 21st April, 1960. (883289.)

14404. Pitney-Bowes, Inc.—Method of and apparatus for magnetically recording information. 25th April, 1960. (883405.)

15287. International Business Machines Corporation.—Magnetic recording medium. 2nd May, 1960. (883428.)

16578. Westinghouse Electric Corporation.—Semiconductor devices. 11th May, 1960. (883290.)

19056. Mallory Metallurgical Products, Ltd.—Manufacture of electrical contact or welding electrode materials. 30th May, 1960. (883429.)

20837. Western Electric Co., Inc.—Electrical switching devices. 14th June, 1960. (Addition to 870906.) (883430.)

20851. Philips Electrical Industries, Ltd.—Ferromagnetic ferrite cores. 14th June, 1960. (883291.)

28404. Thorn Electrical Industries, Ltd.—Electrical inductors. 16th August, 1960. (880815.)

### 1961

21469. Bloembergen, N.—Negative resistance amplifiers. 11th October, 1957. (880479.)

## Trade Mark Applications

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to the dates stated:—

### 1st December

Beckstat. No. 821,306. Class 9. Electrical thermostatic control apparatus.—Kent & Wells, Ltd., Harlequin Avenue, Great West Road, Brentford, Middlesex.

Orbit. No. 808,679. Class 11. Electric lighting fittings for domestic and industrial use.—Walsall Conduits, Ltd., Excelsior Works, Dial Lane, Hill Top, West Bromwich.

Taywil Smithlite. No. 817,374. Class 11. Installations for lighting and heating.—Herman Smith, Ltd., Reliance Works, King Street Passage, Dudley, Worcs.

Stockfield. No. B822,730. Class 11. Lighting fittings and lighting installations.—Stockfield Manufacturing Co., Ltd., Morcom Road, Birmingham.

Impala. No. 822,866. Class 7. Washing machines and drying machines.—Gay-Day (Domestics), Ltd., 47, Chorlton Street, Manchester.

### 8th December

Comtex. No. 821,465. Class 7. Electric motors (not for land vehicles), electric speed governors, etc.—Comtex, Ltd., 43, Portland Place, London, W.1.

Impala. No. 822,866. Class 7. Washing machines and drying machines.—Gay-Day (Domestics), Ltd., 47, Chorlton Street, Manchester.

Koswa. No. 818,277. Class 9. Scientific and electrical apparatus and instruments, testing instruments, thermometers, thermostats, electric time switches, etc.—Koswa, Ltd., Anstey Mill Lane Works, Alton, Hants.

Sabre. No. 819,188. Class 9. Scientific and electrical apparatus and instruments (not including arc welding apparatus and batteries).—Wilkinson Sword, Ltd., 16, Pall Mall, London, S.W.1.

Paristor. No. 823,186. Class 9. Apparatus for calculating electrical resistance and capacitance.—Paristor, Ltd., 96, Park Lane, Croydon, Surrey.

Circular design. No. 821,940. Class 9. Electric vacuum dust extractors.—Joy Sullivan, Ltd., Cappielow, Greenock.

Onan. No. 823,292. Class 9. Electrical control apparatus and control panels.—G.M. Power Plant Co., Ltd., 1-3, Richmond Road, Ipswich.

Plesmet. No. 823,754. Class 9. Electric resistors.—Plessey Co., Ltd., 56, Vicarage Lane, Ilford.

Regor. No. 819,698. Class 11. Electric lighting fittings and appliances.—H. B. Rogers, Ltd., Sandell Street, Waterloo Road, London, S.E.1.

Viscomat. No. 820,961. Class 11. Electrical devices for pre-heating oil fed to oil burners in furnaces and the like.—Duncan Low, Ltd., 57-61, Trossachs Street, Glasgow.



# NEXT WEEK'S EVENTS

*Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 243a, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged, but, in some cases, not yet announced*

## MONDAY, 27th NOVEMBER

**Birmingham.**—James Watt Memorial Institute, Great Charles Street, 6 p.m. I.E.E. South Midland Centre, Electronics and Measurement Group. "Electronics in the Electricity Supply Industry," by Dr. J. S. Forrest.

**Cardiff.**—South Wales Institute of Engineers, 6 p.m. I.E.E. Western Centre, Utilisation Group. "Silicone Electrical Insulation," by J. H. Davis.

**Crewe.**—Mechanics' Institute, 7 p.m. I.E.E. North Staffordshire Sub-Centre. "Electric Traction," by J. A. Broughall.

**Edgbaston.**—Chamber of Commerce, 75, Harborne Road, 6.30 p.m. I.E.S. Birmingham Centre. "Lighting of Large Office Buildings," by J. H. D. Madin.

**Leeds.**—Houldsworth School of Applied Science, University, 7.30 p.m. Institution of Plant Engineers, West and East Yorkshire Branch. "Basic Electronics in Industry and Commerce," by R. H. Garner.

**London.**—John Adam Street, Adelphi, W.C.2, 6 p.m. Royal Society of Arts. Cantor Lecture. "Some Problems of British Export Trade: II Production for Export," by R. M. Geddes.

**Newcastle-upon-Tyne.**—Neville Hall, Westgate Road, 6.15 p.m. I.E.E. North Eastern Centre. "The Place of Formal Study in the Post-Graduate Training of an Electrical Engineer," by N. N. Hancock and P. L. Taylor.

**Watford.**—Compass Hotel, 8.15 p.m. A.S.E.E. North West London Branch. "Modern Electric Lifts."

## TUESDAY, 28th NOVEMBER

**Basingstoke.**—Technical College, Worting Road, 7.30 p.m. A.S.E.E. Aldershot and Districts Branch. "The National Inspection Council," by T. Howell.

**Braunstone.**—Shakespeare Inn, 7.30 p.m. A.S.E.E. Leicester Branch. Ladies' evening.

**Dublin.**—Gresham Hotel. I.E.E. Irish Branch. Dinner-dance.

**Edinburgh.**—Carlton Hotel, North Bridge, 7 p.m. I.E.E. South East Scotland Sub-Centre. "An Impression of Moscow," by Prof. M. G. Say.

**Farnborough.**—Technical College, 7 p.m. British Institution of Radio Engineers, Southern Section. "Data Acquisition Systems," by K. L. Smith.

**Technical College, 6.15 p.m. I.E.E. Southern Centre.** "Brushless Variable Speed Induction Motors Using Phase-Shift Control," by Prof. F. C. Williams, Dr. E. R. Laithwaite, K. F. Eastham and W. Farrer.

**Leeds.**—Great Northern Hotel, Wellington Street, 7 p.m. I.E.E. North Midland Centre, Graduate and Student Section. "Colour Television," by P. S. Carnit.

**London.**—Café Royal, Regent Street, 7 for 7.30 p.m. I.E.E. Measurement and Control Section. Dinner.

**Manson House, 26, Portland Place, 7 p.m.** Society of Instrument Technology. "Automatic Plant Analysis by Electrochemical Methods," by R. F. Rodger.

**Pepys House, 14, Rochester Row, S.W.1, 6.30 p.m.** Institution of Heating and Ventilating Engineers. Debate on "This House Considers that Domestic Heating Installations should be carried out by qualified Heating Engineers and not by other Professions or Trades," proposed by K. W. Dale, opposed by R. G. Sayers.

**Memorial Building, 76, Mark Lane, E.C.3, 5.30 p.m.** Institute of Marine Engineers. Joint panel on Nuclear Marine Propulsion. "High Temperature Reactors for Marine Propulsion," by Dr. J. E. Richards.

**Manchester.**—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North Western Centre Supply Group. "General and Topo-

logical Features of Some Hydro and Thermal Schemes," by Dr. J. R. Mortlock.

**Nottingham.**—University, 6.30 p.m. I.E.E. East Midland Centre. Third Hunter Memorial Lecture. "The Application of Electronics to the Electricity Supply Industry," by Dr. J. S. Forrest.

**Swansea.**—Electricity Showrooms, 62, Kingsway, 7 p.m. Institution of Plant Engineers, South Wales Branch. "Design for Maintenance," by R. N. Dale.

## WEDNESDAY, 29th NOVEMBER

**Cambridge.**—Cavendish Laboratory, Free School Lane, 8 p.m. I.E.E. Cambridge Electronics and Communications Section. Chairman's address, "Global Communication," by R. J. Hailey.

**Chatham.**—Medway College of Technology, Maidstone Road, 7 p.m. I.E.E. Chatham District. "Some Aspects of the Control and Guidance of Guided Weapons," by J. A. Miller.

**Dewsbury.**—Yorkshire Electric Transformer Co., Ltd. I.E.E. North Midland Centre, Graduate and Student Section. Visit.

**Glasgow.**—Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, C.2, 6 p.m. I.E.E. South West Scotland Sub-Centre. "The Banana-Tube Display System—A New Approach to the Display of Colour Television Pictures," by Dr. P. Schagen.

**Kettering.**—George Hotel, 7.30 p.m. I.E.E. East Midland Centre. "The Kariba Dam Project—Electrical Installations," by C. J. Dickinson.

**London.**—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Electronics and Communications Section. "Recent Developments in Semiconductor Devices and their Applications," by E. Wolfendale.

**School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1, 6 p.m.** British Institution of Radio Engineers, Electro-Acoustics Group. "An Experimental Assessment of Loudspeaker Performance," by R. Yorke.

**John Adam Street, Adelphi, W.C.2, 6 p.m.** Royal Society of Arts. "Television in Schools," by P. Adorian.

**Manchester.**—Reynolds Hall, College of Science and Technology, 7 p.m. I.E.E. North Western Centre, Graduate and Student Section. Annual film evening.

**Portsmouth.**—C.E.G.B. Offices, High Street, 6.30 p.m. I.E.E. Southern Centre. "Technical and Economic Aspects of the Supply of Reactive Power in England and Wales," by W. Casson and H. J. Sheppard.

**Rugby.**—College of Engineering Technology, 6.30 p.m. I.E.E. Rugby Sub-Centre. "An Oscillating Synchronous Linear Machine," by Dr. E. R. Laithwaite and R. S. Mamak; and "The Application of Linear Induction Motors to Conveyors," by Dr. E. R. Laithwaite, D. Tipping and D. E. Hesmondhalgh.

**Sheffield.**—University, 7 p.m. I.E.E. Sheffield Sub-Centre, Graduate and Student Section. "Colour Television," by P. S. Carnit.

## WEDNESDAY, 29th NOVEMBER to FRIDAY, 1st DECEMBER

**London.**—Iron and Steel Institute. Autumn general meeting. (At the Federation of British Industries, Tothill Street, S.W.1, and the offices of the Institute, 4, Grosvenor Gardens, S.W.1.)

## THURSDAY, 30th NOVEMBER

**Chelmsford.**—Social Hall, Crompton Parkinson, Ltd., 7.30 p.m. Chelmsford Engineering Society. "The Prospects for Capital Goods in East/West Trade," by J. B. Scott.

**London.**—Connaught Rooms, W.C.2, 12.30 for 1 p.m. Batti-Wallahs' Society. Luncheon.

**Sheffield.**—Grand Hotel. Institution of Plant Engineers, Sheffield Branch. Dinner and dance.

## THURSDAY, 30th NOVEMBER and FRIDAY, 1st DECEMBER

**London.**—Institution of Electrical Engineers, Savoy Place, W.C.2. Measurement and Control Section. Nuclear Electronic Symposium. (In conjunction with the British Nuclear Energy Conference.)

## FRIDAY, 1st DECEMBER

**Cheltenham.**—North Gloucestershire Technical College, 7 p.m. British Institution of Radio Engineers, South Midlands Section. "Electronic Telephone Exchanges," by J. F. Hesketh.

**Chester.**—Queen's Hotel, City Road, 8 p.m. A.S.E.E. Chester and Districts Branch. Annual dinner and dance.

**Fawley.**—Room 4a, Administration Building, Esso Petroleum Co., Ltd., 5.45 p.m. Society of Instrument Technology, Fawley Section. "Applications of Transistors and Diodes," by D. Osborne.

**Liverpool.**—M.A.N.W.E.B. Industrial Development Centre, Paradise Street, 7.30 p.m. A.S.E.E. Liverpool and District Branch. "Mechanics of the Human Body," by Prof. R. G. Harrison.

**Newcastle-upon-Tyne.**—Grey Hall, King's College, 6.30 p.m. I.E.E. North Eastern Graduate and Student Section. "Radiation, its Detection, Measurement and Uses," by B. Nugent.

**Crown Hotel, Clayton Street. A.S.E.E. Newcastle-upon-Tyne and District Branch.** Annual pot-pie supper.

## Welding Engineering

The first exhibition of the Institute of Welding will take place in conjunction with the Spring Meeting of the Institute in Buxton, Derbyshire, from 2nd to 4th May next year. The subject of the meeting itself is "Welding for Power Generation" and, at the technical sessions, 30 papers on related topics will be presented and discussed. The exhibition will cover all processes and techniques with which the Institute is primarily concerned, namely welding, brazing, soldering, cutting metal, spraying, manipulating, inspection, testing and safety. A section will be devoted to research and a display of detailed illustrations of welded construction. There will also be an exhibition of welding publications from all parts of the world.

## Safe Wiring

The Electrical Development Association have produced a poster and leaflet, entitled "Is Your Wiring Safe and Adequate?" Produced for Fire Prevention Week, the leaflet gives various do's and don'ts for electrical safety.



# CONTRACT INFORMATION

## Accepted Tenders and Prospective Electrical Work

### CONTRACTS OPEN

**Australia.**—State Electricity Commission of Victoria. 11th December. A.C. standby plant. (E.S.B. 34619/61.)\*

Townsville Regional Electricity Board. 8th January. Telecommunication equipment. (E.S.B. 34997/61.)\*

Southern Electric Authority of Queensland. 16th January. Three 60 MW steam turbo-alternators. (E.S.B. 35182/61.)\*

**Buntingford.**—Parish Council. 1st January. Trunk road lighting. (See Classified Advertisement Section.)

**Chelmsford.**—Borough Council. 11th December. Group "B" street lighting, St. John's Road area. Borough engineer, Coval Lane

**Darlington.**—Corporation. 11th December. Electrical installations in 46 houses on the Fifth Moor estate. Borough architect, Central Buildings.

**Durham.**—County Council. 6th December. Divisional police station and court house, Peterlee. (See Classified Advertisement Section.)

**Hastings.**—Corporation. Contractors wishing to tender for the electrical installation in Parkstone Road Grammar School should submit their names by 4th December. (See Classified Advertisement Section.)

**India.**—India Store Department. 18th December. Aircraft plugs, sockets and electrical accessories, 2nd January. Station battery banks for Sharavathi generating station and Shimoga and Bangalore substations. (See Classified Advertisement Section.)

Atomic Energy Establishment, Trombay. 15th December. Motor control system. (E.S.B. 35122/61.)\*

**Kuwait.**—Department of Electricity, Water and Gas. 13th December. Cables and joint boxes. (E.S.B. 35472/61.)\* 31st December. Switchgear. (E.S.B. 35477/61.)\* 10th December. Cables. (E.S.B. 35475/61.)\*

**New Zealand.**—Director General (Stores Division), G.P.O., Wellington. 17th January, 1962. Primary cells. (E.S.B. 35438/61.)\*

Auckland Electric Power Board. 19th January. 6.6 kV switchgear. (E.S.B. 34994/61.)\*

**Nicaragua.**—La Empresa Nacional de Luz y Fuerza, Managua. 15th January. Cable. (E.S.B. 35562/61.)\*

**Pinner (Middlesex).**—N.A.T.O. Common Infrastructure. 5th June. Naval base installations. (See Classified Advertisement Section.)

**Portuguese West Africa.**—Light and Water Board, Luanda. 6th December. Transformer substations. (E.S.B. 34999/61.)\*

**Potters Bar.**—U.D.C. 8th December. Rewiring of 50 houses, Cranborne Road. (See Classified Advertisement Section.)

**Skelton and Brotton.**—U.D.C. 6th December. Wiring of 56 houses and bungalows on Marske Lane estate. Surveyor, Council Offices.

**Southport.**—Borough Council. 10th January. Electrical installation in connection with extensions to the Canning Road bus depot. Town planning officer, 99/105, Lord Street, Southport.

\* This information is extracted from the Board of Trade *Export Service Bulletin*. Inquiries should be addressed to the Board of Trade, Export Services Branch, Lacon House, Theobald's Road, London, W.C.2 (Telephone: Chancery 4411, Ext. 738), quoting the reference given.

**South Vietnam.**—Central Purchasing Authority. 15th December. Intercommunication system. (E.S.B. 35199/61.)\*

### ORDERS PLACED

**Durham.**—County Education Committee. Renewal of electrical wiring, Billingham R.C. Aided School (£1,941).—Cox Walkers. Electrical work in additions to Eppleton Colliery Modern School (£2,110).—North of England Engineering & Electrical Co.

**Hastings.**—Education Committee. Rewiring for a new heating installation in the education department (£1,685).—S. F. Chapman & Son.

**Newcastle-on-Tyne.**—Regional Hospital Board. Electrical work in new ear, nose and throat department at North Riding Infirmary (£1,341) and provision of electrical distributors at Bishop Auckland General Hospital (£8,097).—Doves (Darlington). Electrical work in additions to the Board's headquarters (£7,000) and in temporary casualty department at Cumberland Infirmary (£4,257).—J. Scott & Co. (Electrical Engineers). Extensions to telephone system at Newcastle General Hospital (£3,715).—Communications Systems. Electrical installation in boiler house at Hartlepool Hospital (£1,800).—Haigh & Ringrose. Electrical work at new West Cumberland Hospital (£164,873).—G. Bowman.

**Seaton Valley (Northumberland).**—U.D.C. Electrical installation in 32 houses at Seghill. Surveyor, Council Offices, Seaton Delaval.

### WORK IN PROSPECT

*Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors*

**Acton.**—Four-storey office block, Wesley Avenue; Wesley Estates, Ltd., Wesley Avenue.

**Ammanford.**—Extension to technical college (£50,000); R. R. Jennings & Partners, services consultants, 39, Byrom Street, Manchester, 3.

**Aycliffe (Co. Durham).**—Houses (359) for Aycliffe Development Corporation, Churchill Square, Newton Aycliffe; own architects.

**Beaconsfield.**—Flats (33), Shepherd's Lane and Ferns Road; Harry Chapples, Ltd., Highway Works.

**Bicester.**—Primary school, Tower Hill; Gerald Banks, architect, 5, London Road.

**Burton-on-Trent.**—Robert Sutton R.C. Secondary Modern School, Bluehouse Lane; Sandy & Norris, architects, 134, Newport Road, Stafford.

**Chandlers Ford.**—Shops (28), supermarket, showrooms, offices and maisonnettes, Winchester Road; Town & City Properties, Ltd., Kingsbury House, King Street, S.W.1.

**Chatham.**—Office block for Northern Assurance Co., Ltd., in New Road; P. Ednie & Partners, architects, 4, Gray's Inn Square, London, W.C.1.

**Earls Barton.**—Extensions to factory; Tresco Plastics, Ltd., High Street, Earls Barton, Northants.

**Eastbourne.**—Five-storey office block, Ivy Terrace; Jackson & Greenen, architects, Hinton Buildings, Bournemouth.

**Erith.**—Shops (100), flats, maisonnettes and offices, redevelopment of town centre;

R. Seifert & Partners, architects, 34, Red Lion Square, London, W.C.1.

**Farnworth.**—Dwellings (80), Harper Green estate; borough surveyor.

**Glasgow.**—Maisonnettes (60), Fortrose Street; Scottish Special Housing Association, Ltd., 15, Palmerston Place, Edinburgh, 12.

Houses (169), Pollokshaws redevelopment, Areas A and B; Planning Department, 20, Trongate.

**Hornsey.**—Central library; borough engineer, Town Hall, Hornsey, N.8.

**Isleworth.**—Seven-storey offices, London Road/Worton Way site; Raymond Spratley & Partners, architects, 9, Hertford Street, Park Lane, London, W.1.

**London.**—Supermarket, High Street, Clapham; R. Seifert & Partners, architects, 34, Red Lion Square, W.C.1.

Five-storey block of flats, Brixton Hill, Lambeth; Shaw & Lloyd, architects, 74, Great Russell Street, W.C.1.

Fourteen-storey block of flats, Burrage Road, Woolwich; Norman and Dawbarn, architects, 243, Stockwell Road, London, S.W.9.

**Macclesfield.**—Dwellings (60), Weston estate; Langley Bros., 43, Werrington Road, Bucknal, Staffs.

**Middlesbrough.**—Houses (41) and flats (16), Dunstable Road; borough engineer.

**Oldham.**—Three-storey flats (120), Fitton Hill estate; Cameron & Middleton, quantity surveyors, 21, Mumps, Oldham.

**Peterborough.**—Houses (71), Thorpe Gardens development; C. W. Shelton, Ltd., South Street, Stanground, Peterborough.

Houses and garages (46), Westwood estate development; Netherton Building & Construction Co., Ltd., 13, Milton Street, Peterborough.

**Salisbury.**—Shopping centre, offices, etc., New Street and High Street; Hammerson Development, Ltd., Quadrex House, Park Lane, W.1.

**Stroud.**—Fire and ambulance stations, Paganhill Lane; county architect, Shire Hall, Gloucester.

**Thurrock.**—Public hall and swimming pool, King George's Field, Blackshots (£501,990); U.D.C. surveyor, Palmers Avenue, Grays, Essex.

**Tring.**—Dwellings (103), Meadow Close; Woodroffe, Buchanan & Coulter, architects, 41, High Street.

**Wallingford.**—Houses (24), Church Lane and Goldsmith's Lane; T. Langton Foster, architect, 72, Wantage Road, Wallingford, Berks.

**West Hartlepool.**—Maternity and child welfare centre, Seaton Carew; borough architect, Municipal Buildings.

**Weston-super-Mare.**—Dwellings (88), Old Mixon estate; borough engineer.

**Willenhall.**—Office block, Ductile Steels, Ltd., London Road.

**Windsor.**—Outpatients', casualty and X-ray departments, King Edward VII Hospital; John R. Harris, architect, 30, Queen Anne Street, W.1.

**Withernsea.**—Dwellings (122), Clovelly estate; T. R. Barnett, Ltd., Curzon Street, Hull.

**Wood Green.**—Single- and two-storey factories on Bounds Green Industrial Estate; Borough engineer, Town Hall, N.22.

**Wrotham.**—Aged persons' bungalows (20), West Street; Maling R.D.C. surveyor, Council Offices, West Malling, Kent.

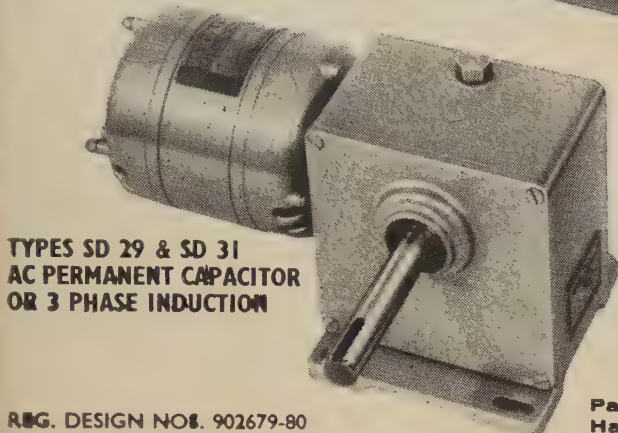
**York.**—Church, Acorn Road; Peter R. Nuttall, architect, 5, Kay Street, Rawtenstall.



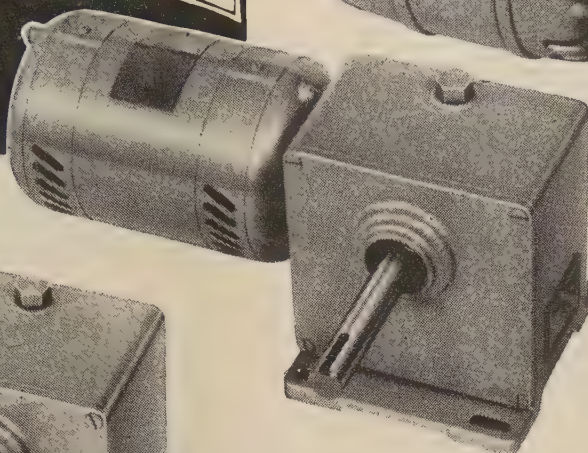
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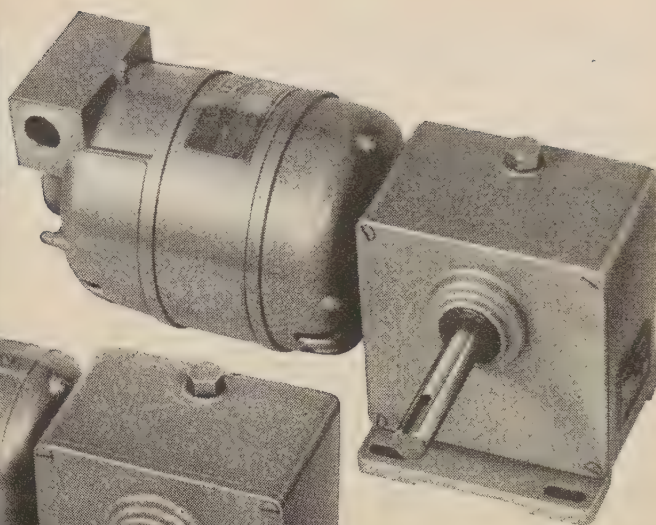
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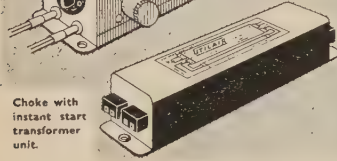
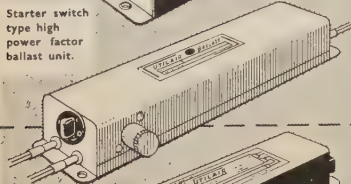
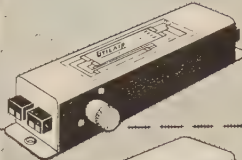


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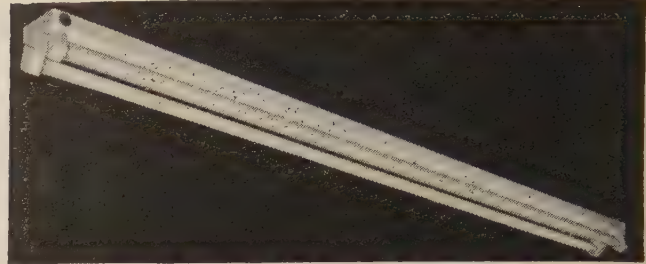
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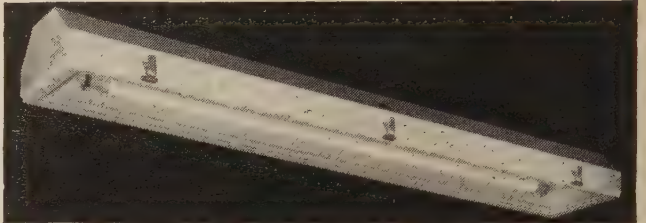
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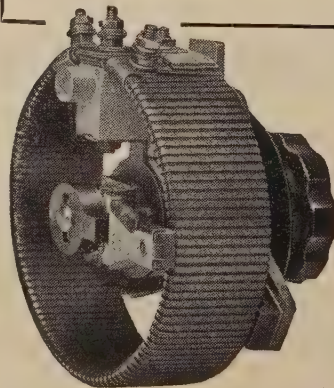
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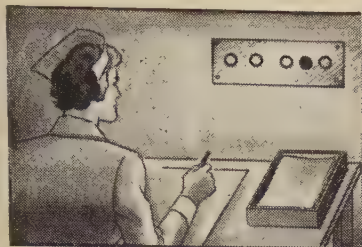
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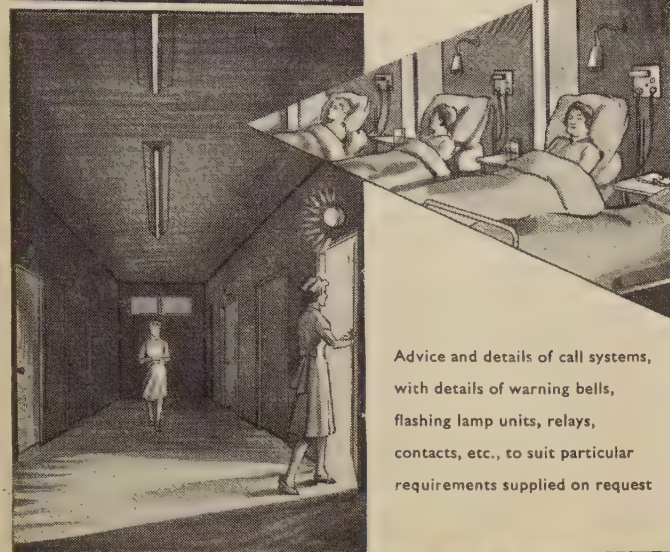




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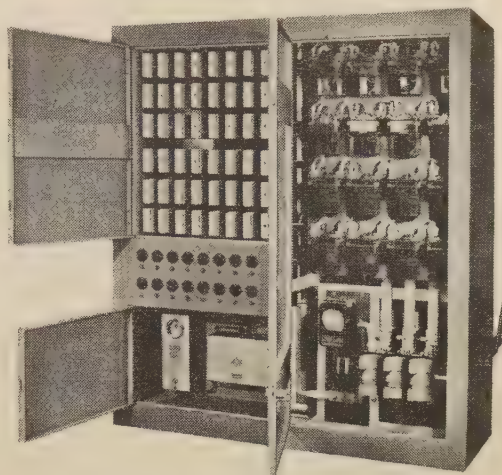
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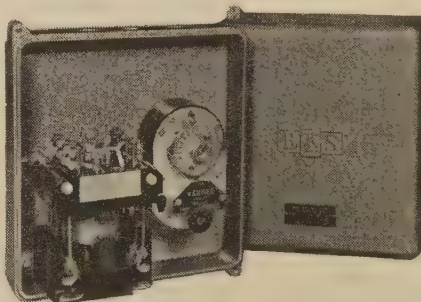
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Most people want the comfort of modern amenities—but few like the towers that bring the power to work them. What's the answer? Return to lamplight, peat fires and the washing tub? Bury the power lines and do away with the towers altogether? Attractive idea—just possible too, but at 17 times the cost—with its inevitable effect on your electricity bill. For the foreseeable future, transmission towers must stay. But they cannot be planted just anywhere. An Act of Parliament charges the Central Electricity Generating Board with a double duty: to provide an efficient and economical electricity supply, while preserving visual amenity as far as possible. Power lines are planned with forethought—by men who are as anxious as you are to keep this land green, pleasant... and up-to-date.



■ These advertisements are appearing in the farming and country magazines. The Central Electricity Generating Board thank electrical contractors for their co-operation in the past, and know that they will do all they can to preserve the amenities of the countryside.



who make and supply electricity to 12 Area Electricity Boards in England and Wales (which re-sell to consumers) and British Railways.

Write for a copy of "Preserving Amenities" to The Central Electricity Generating Board, 75 Winsley Street, London, W.1



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(Continued on page 77)



(Continued from page 76)

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(Continued on page 78)



(Continued from page 77)

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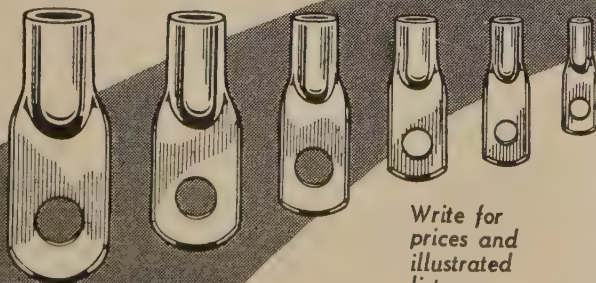
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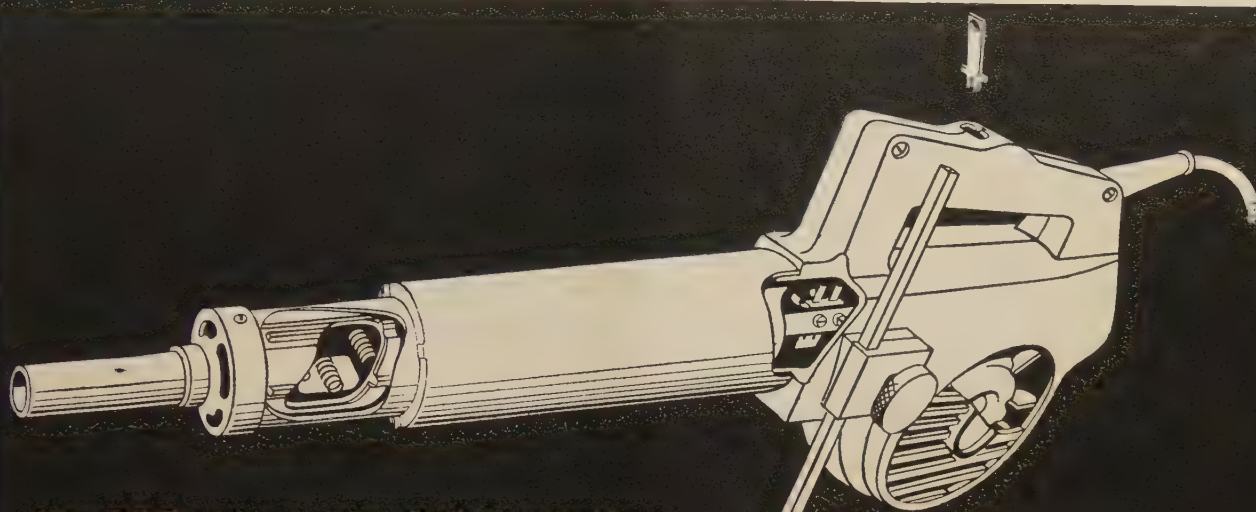
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ER/E16/11



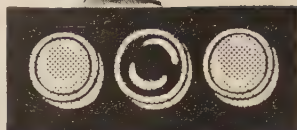
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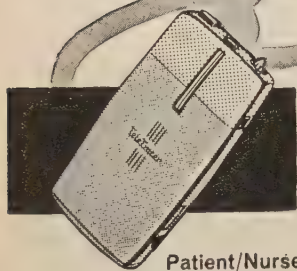


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Signalling ▶

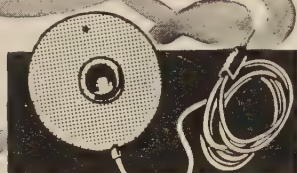


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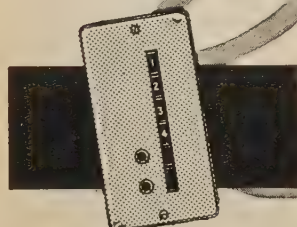


◀ Wireless Pocket Paging

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## of communication

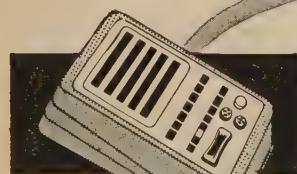


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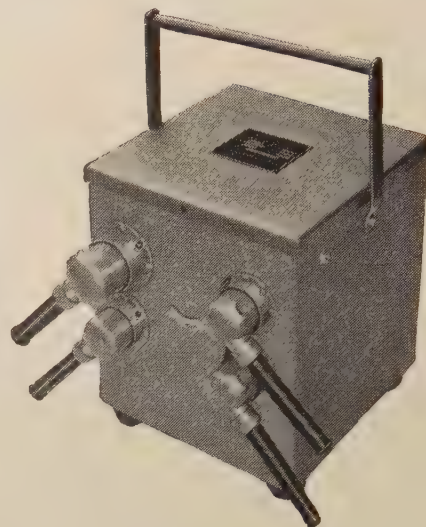
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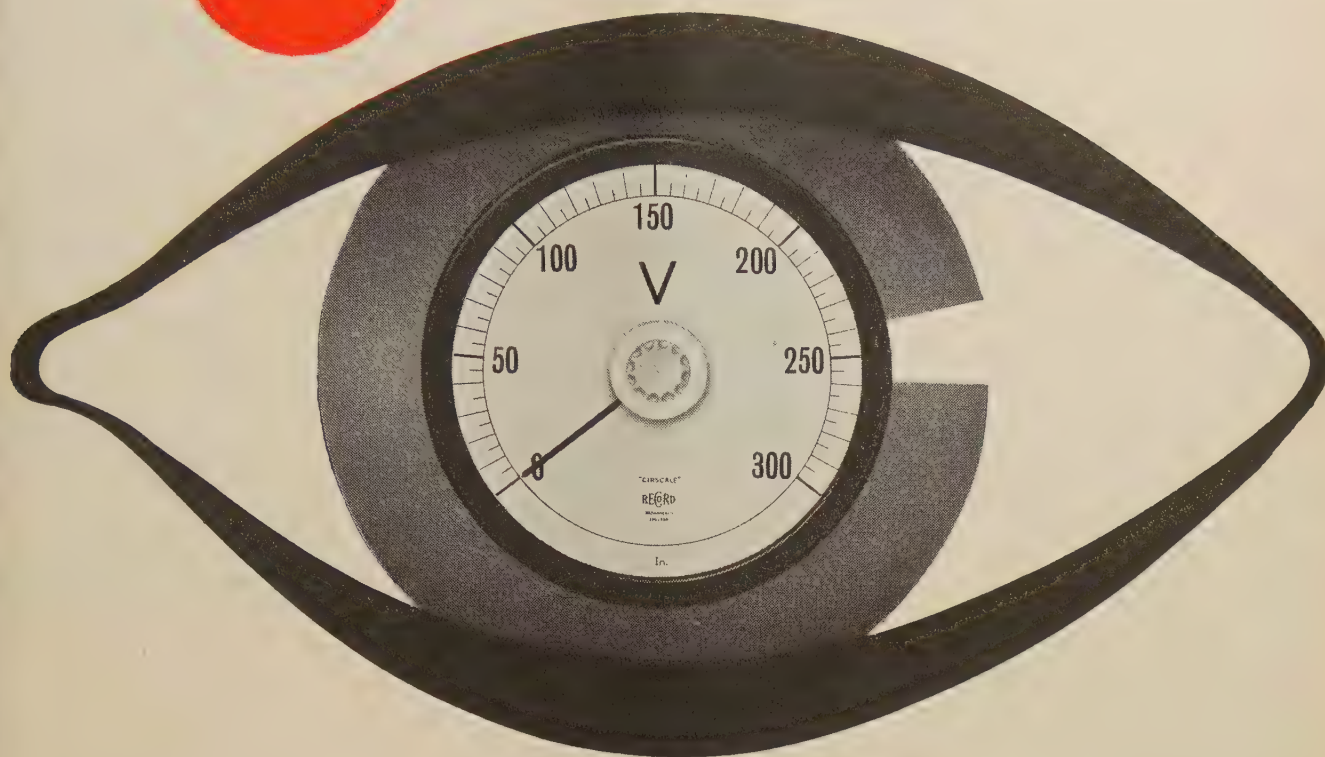
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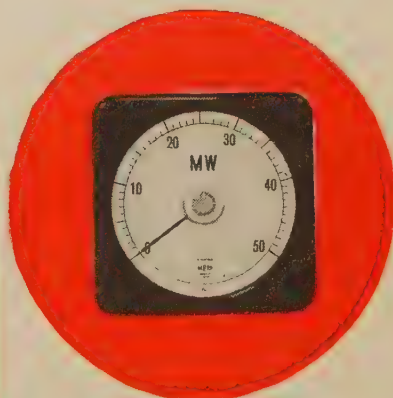


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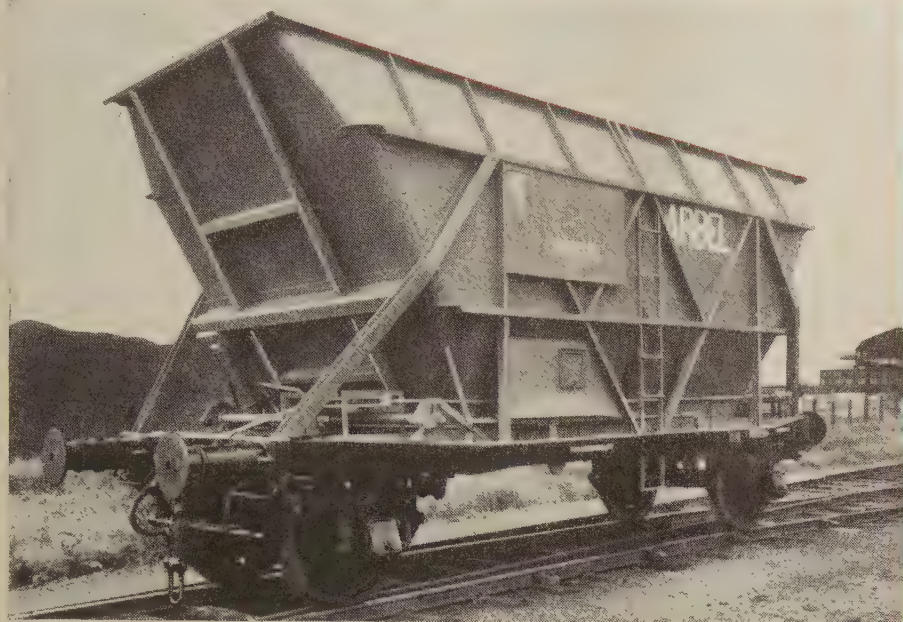
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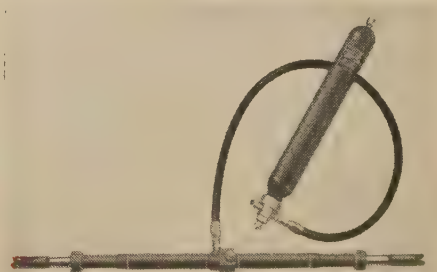
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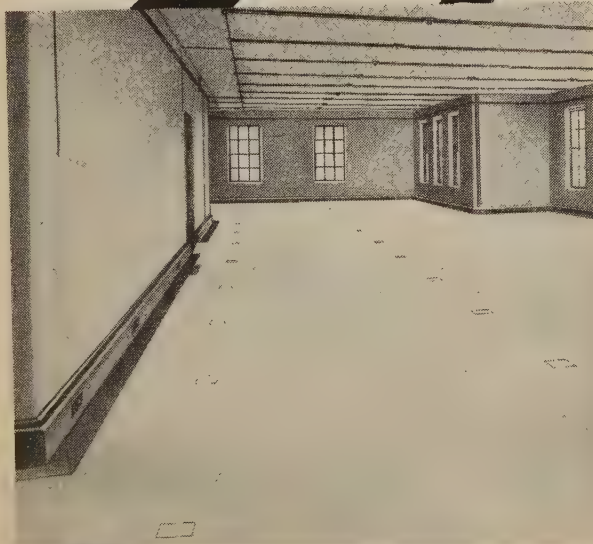


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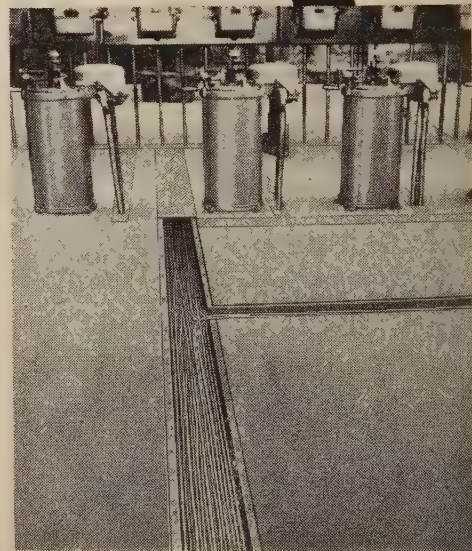
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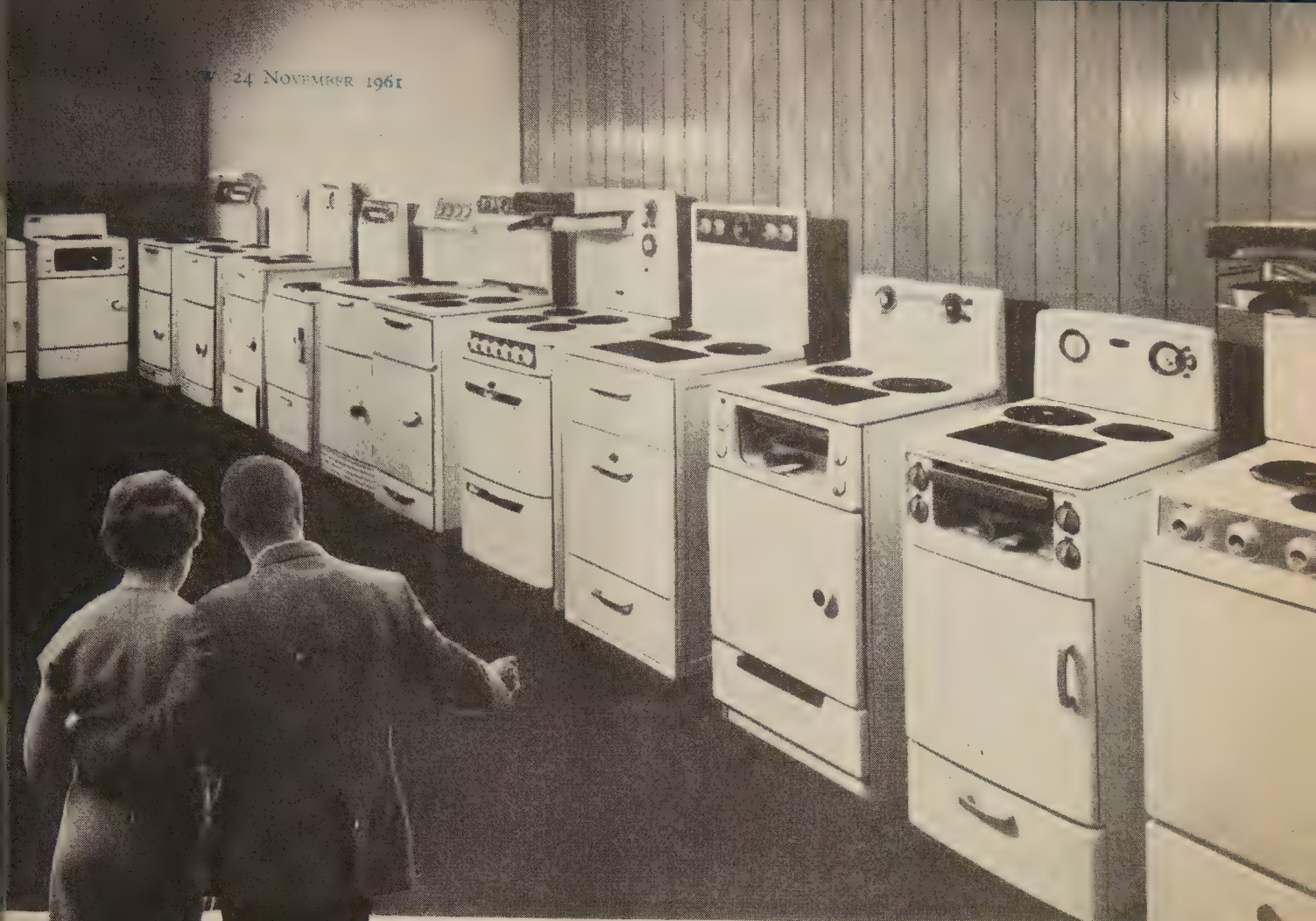
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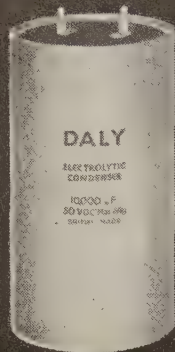
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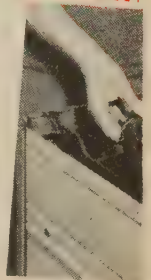


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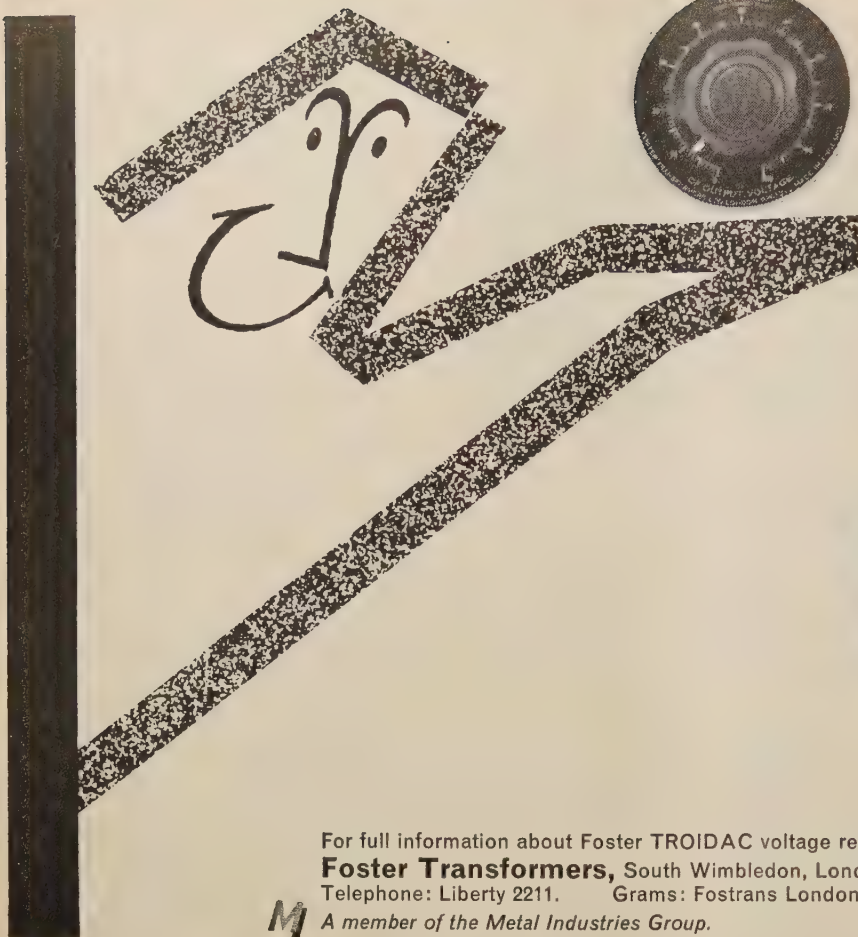


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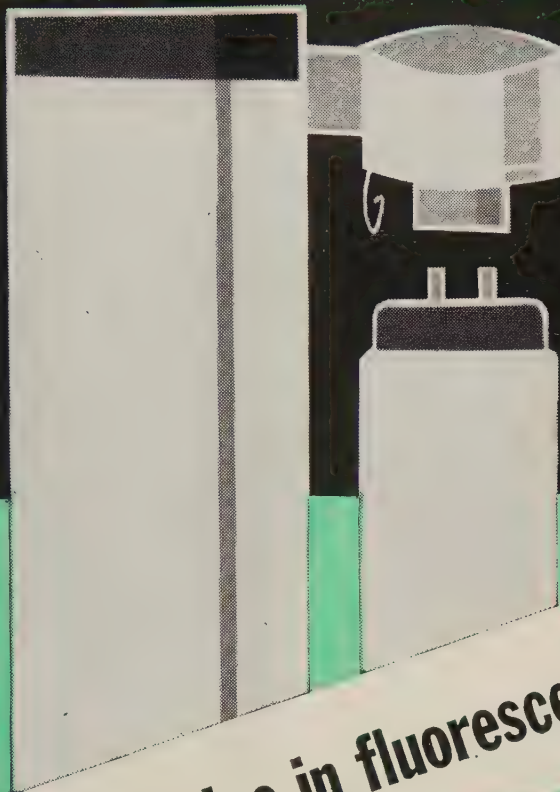
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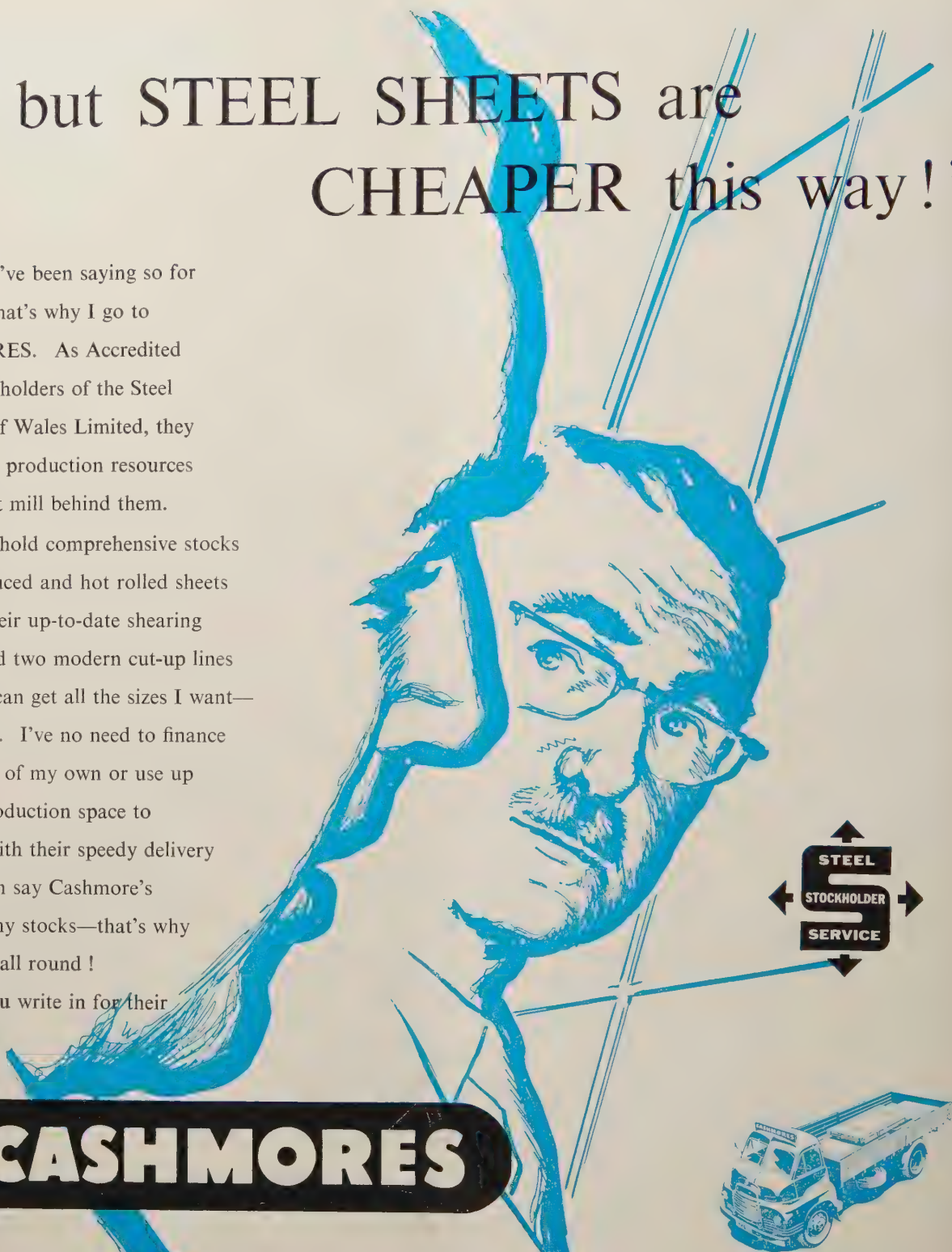
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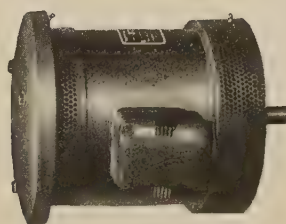
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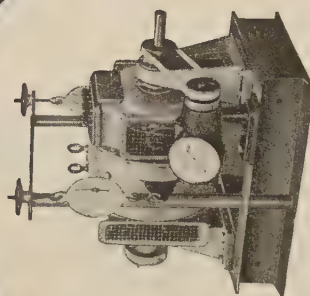
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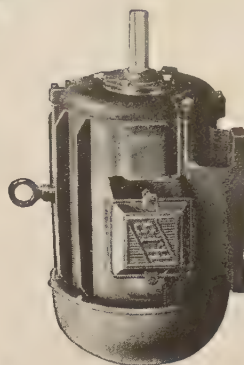
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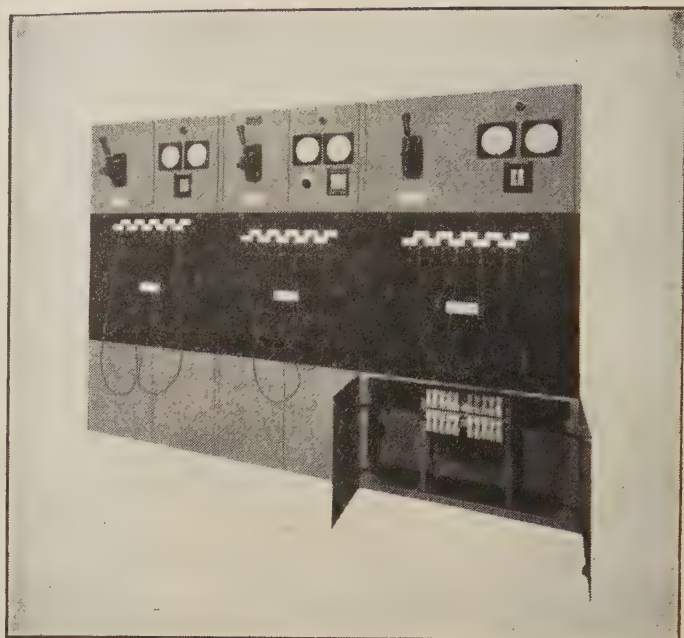
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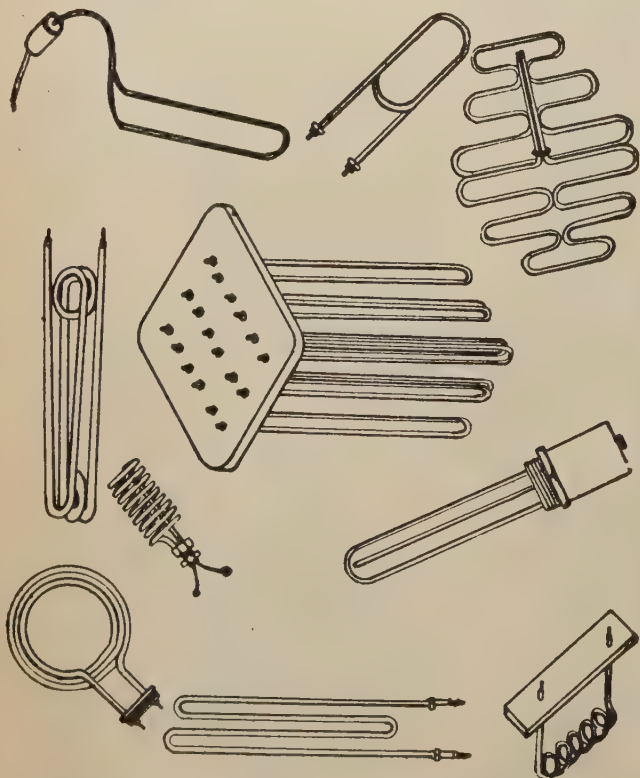


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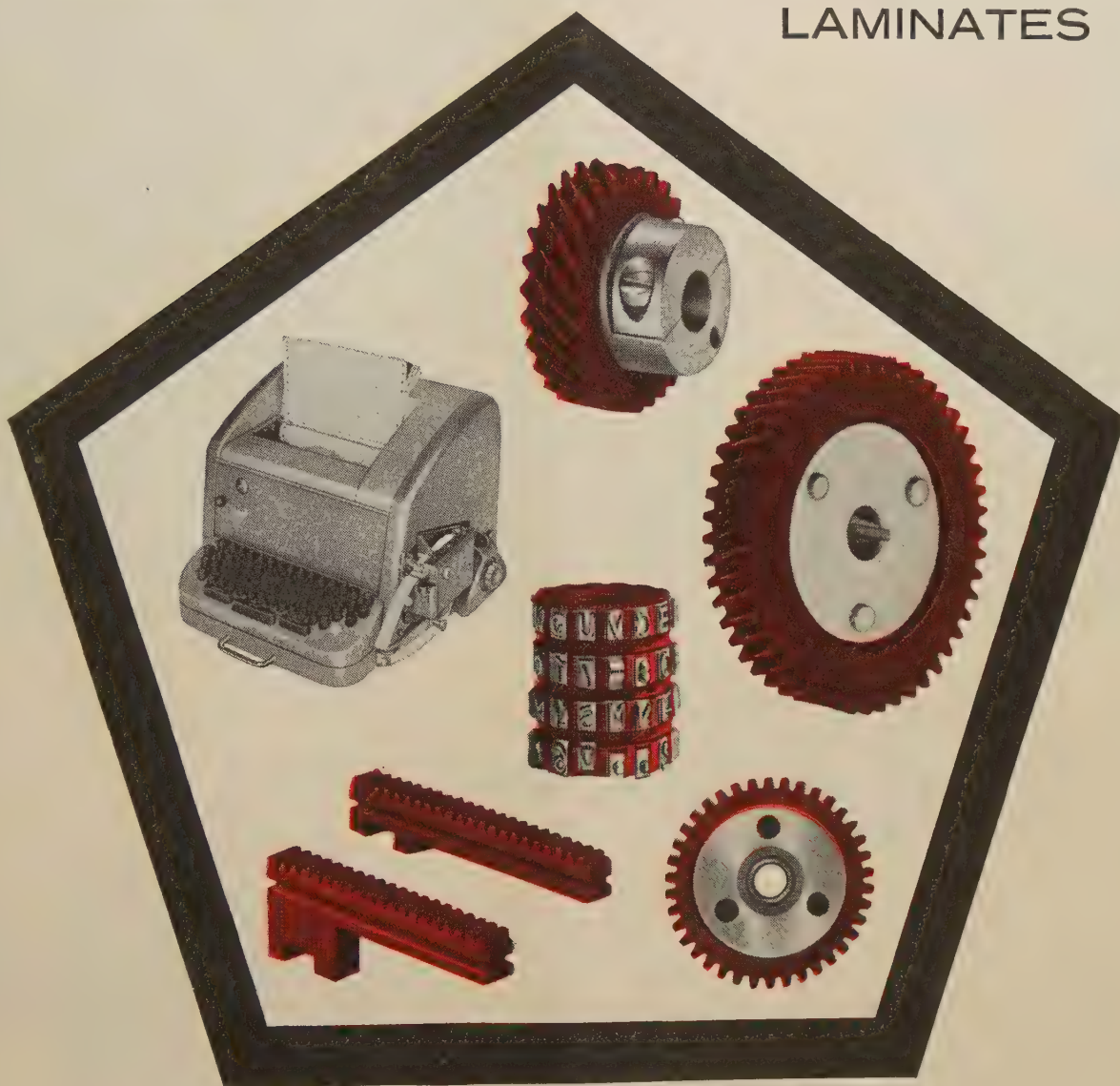


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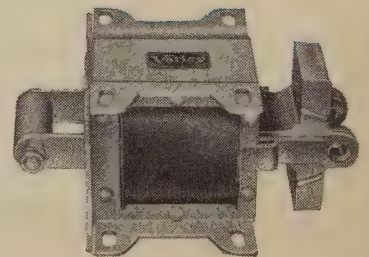
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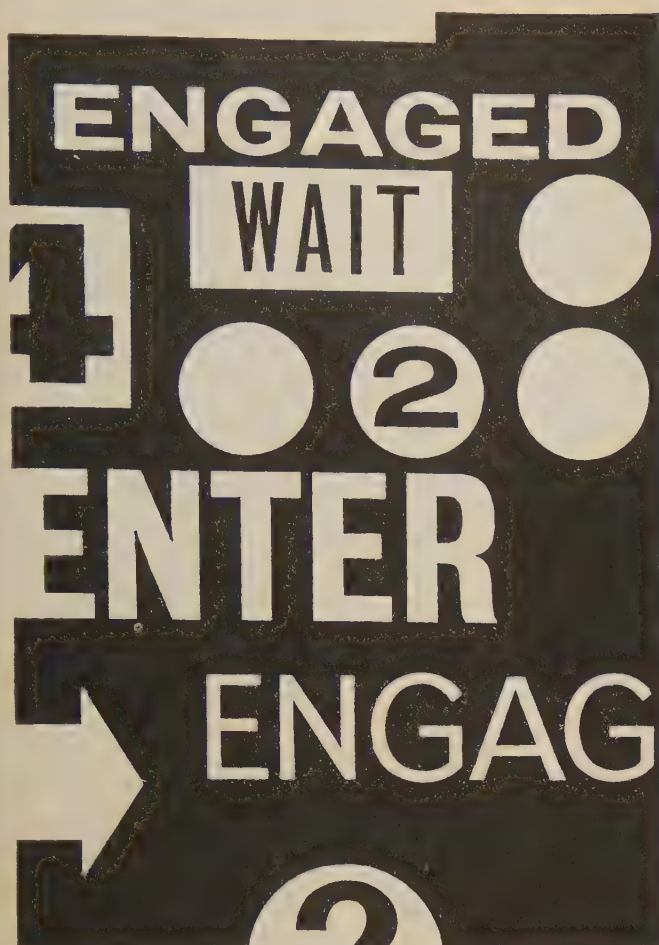
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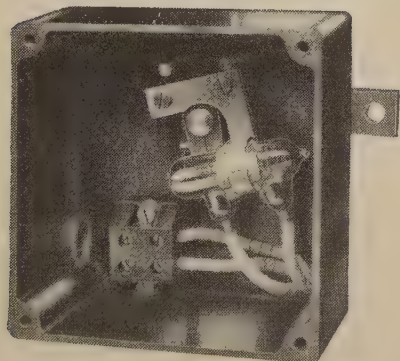
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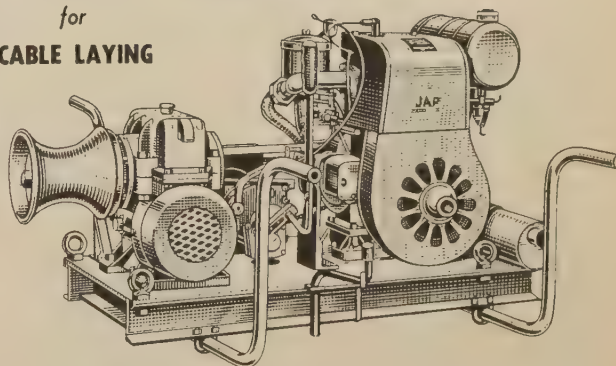
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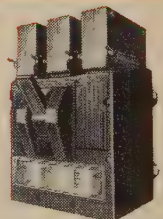
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**GWB**

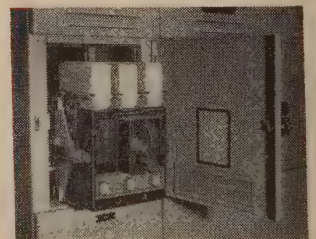
**CONTROL GEAR**

**CONTROL GEAR DIVISION G.W.B. FURNACES LIMITED**  
DUDLEY • WORCESTERSHIRE • TELEPHONE: DUDLEY 55455

*Associated with Gibbons Bros. Ltd. and Wild-Barfield  
Electric Furnaces Ltd.*



*Type Z 630-600 amp air circuit breaker having a K.E.M.A. certified breaking capacity of 20 KA at 500 volts A.C. (equivalent to 15 MVA at 415 V.A.C.)*



*Section of a typical L.V. Distribution Switchboard using Z 630 Draw-out pattern air circuit breakers in multi-tier formation.*



... only  
**LUCAS**  
silicon  
voltage  
regulators  
have  
all  
these  
features

The Lucas range of Silicon voltage regulators, covers the voltage range between 8.2 and 33 volts. The regulators are available either as Zener Diodes for D.C. voltage regulation, or as Clipper Diodes for A.C. amplitude control.

## FEATURES

- ★ Hermetically sealed
- ★ Operating ambient temperature,  $-55^{\circ}\text{C}$  to  $+150^{\circ}\text{C}$
- ★ Zener voltage tolerance  $\pm 10\%$
- ★ Stud mounted
- ★ Small physical size

See technical data sheet for further information



Available in anode to stud, cathode to stud, or double anode versions. Single anode devices may also be used as low voltage rectifiers, having normal rectifier forward characteristics. High power-handling capacity. Available in higher voltage ranges—up to 100 volts (single anode devices only). Good delivery. Competitive prices. Sales Engineers covering the country and an Applications Team available to advise on all customers' problems.

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**Joseph Lucas Ltd**

Sales &amp; Technical Applications

**G & E Bradley Ltd**

ELECTRAL HOUSE, NEASDEN LANE, LONDON N.W.10

Telephone: Dollis Hill 7811

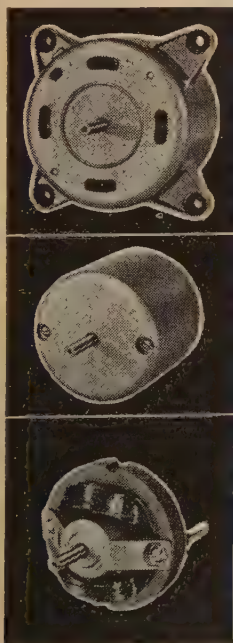
A Subsidiary Company of Joseph Lucas (Industries) Ltd



**CASSOR**

HIGH QUALITY

Fractional horse-power electric motors



1-20 watts output for

fan units — heaters —  
projectors — cooling  
equipment — tape recorders  
record players, etc.

**Geared Motors**  
for special applications

**Silent running**  
with self lubricating  
sintered bronze bearings

A Variety of fixings with open,  
semi-enclosed or enclosed housings

Comprehensive Catalogue forwarded  
on request

Sole distributors:—

**CASSOR ELECTRIC MOTORS LTD.**

10 BURY PLACE, NEW OXFORD ST., LONDON, W.C.1. Tel.: CHAncery 4606



**LAMPHOLDER**

T.M. 401

**L.C.C. APPROVED**



**BODY AND CAP**

One-piece moulding. Live parts cannot  
be accidentally exposed!

**STEATITE INTERIOR**

Separates flexibles. Short circuits are  
impossible!



**CORD GRIP**

Self anchoring!

Special Prices for Quantities

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FOR  
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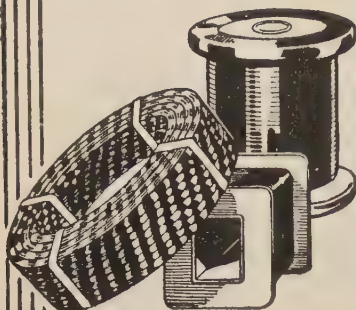


**GEORGE TURNOCK LTD.**

NAVIGATION STREET  
WALSALL, STAFFS.

(Telephone: Walsall 24966)



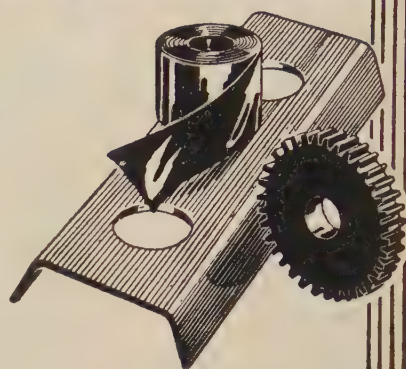
**INSTRUMENT WIRES**

Specialists in Extra Fine Insulated Copper and Resistance Wires. Litz Wires. Plastic Insulated Miniature Cables.

Mica, Micanite and Bakelite in all forms. Varnished Fabric Cloth, Tape and Sleeving. Plastic Sleeving. Machined Pieces. Slot Insulations. Varnishes.

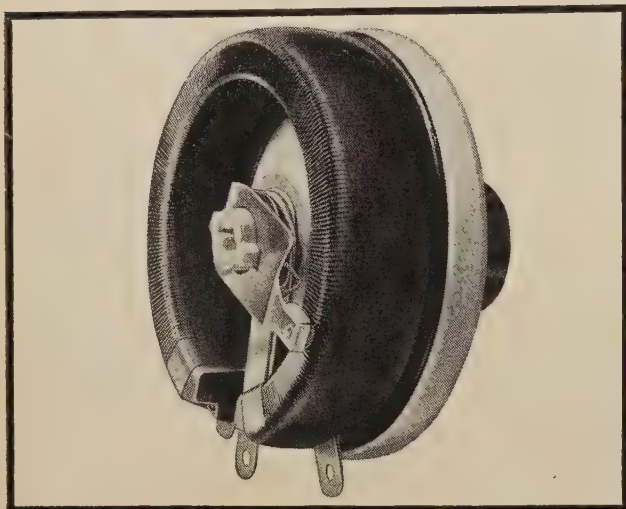
**WEST INSULATING COMPANY LTD.**

1 Scotts Road, Bromley, Kent  
Telephone: Ravensbourne 8588. Telegram: Etflur, Bromley

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# **expamet** **cressall**

## **TOROSTATS**



Toroidally wound vitreous enamelled potentiometer rheostats. Wound on ceramic ring fused to very substantial ceramic base. 25 watts to 150 watts.

# **expamet** **cressall**

**THE CRESSALL MANUFACTURING COMPANY LIMITED**  
Cheston Road · Birmingham 7 Telephone: EAST 3571

London Office: 16 Carlton Street, S.W.1 · Telephone: ABBey 7768  
Electrical Division of The Expanded Metal Company Limited

**PORTABLE FURNACE & PATENTS CO.**

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Phone 64887

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**COMPOUND  
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**Furse**

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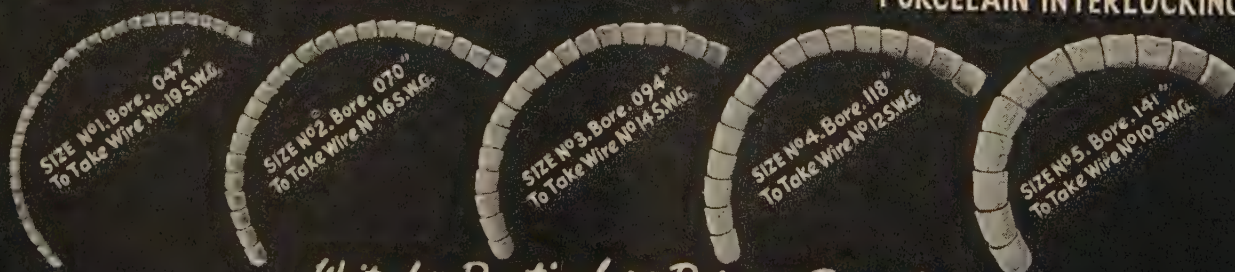
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33 Traffic Street (Tel. 83471-5 lines) NOTTINGHAM  
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**VEE-GEE INSULATING BEADS**

**BRITISH MADE  
PORCELAIN INTERLOCKING**



*Write for Particulars Prices & Samples*

**GORST RD. PARK ROYAL V.G. PORCELAIN CO LTD LONDON, N.W.10**



# Classified Advertisements

CLASSIFIED advertisements are PREPAID at 4/- per line (approx. 6 words).

DISPLAYED CLASSIFIED:—53/- per single column inch.

Where an advertisement includes a Box Number there is an additional charge of 1/-.

SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

Remittances payable to "ELECTRICAL REVIEW."

REPLIES TO BOX NUMBERS should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1. If an applicant for a situation appearing under a Box Number does not wish his reply to be forwarded to a particular firm or individual, instructions to this effect should be addressed to the Advertisement Supervisor, ELECTRICAL REVIEW. The name of an advertiser using a Box Number cannot be disclosed.

## OFFICIAL NOTICES, TENDERS, ETC.\*

### N.A.T.O. COMMON INFRASTRUCTURE SLICE VIII

#### Naval Base Installations

FINAL notice is hereby given that International Competitive Bids will be invited on or about 2nd April, 1962, for the supply and installation of the complete electrical installation for a P.O.L. storage depot to be constructed at Campbeltown, Scotland. Funds for this project were requested under N.A.T.O. paper AC/4 (PP)D/3146.

The system will be 415 volts, 3-phase, 4-wire, 50 cycles, A.C.

2. The approximate total value of the works is £50,000 and the contract will comprise flame-proof and industrial equipment for the following purposes:—

- Power distribution and control, including switchgear, cables and starters.
- Lighting of roads, tankage areas and jetty.
- Power and lighting in buildings.
- Oil pipeline heating system.
- Earthing and bonding.

3. All the work will be carried out as one contract which will be undertaken as a sub-contract within the framework of the main contract for the construction of the depot. Bids for the main contract have been invited.

4. It should be noted that the importation of labour from sources outside the United Kingdom may be subject to restriction and that permission could, in any case, only be given on an undertaking that the contractor would pay rates of wages and observe hours and conditions of labour not less favourable than those established for U.K. labour for the trade or industry in the same area.

5. The closing date for the receipt of bids will be 5th June, 1962.

6. Firms wishing to bid for the whole of the electrical work must formally notify their desire by application to the address below by 2nd February, 1962.

7. Within one week of the closing date for the receipt of applications to bid, firms wishing to be invited must forward the following information:—

- (i) Statement of financial resources and evidence of financial stability.
- (ii) Details of recent major contracts completed for work of a comparable nature, including an indication of the value of each.

8. Enquiries regarding bidding should be addressed to:—

Director General, Navy Works,  
Admiralty,  
Chamberlain Way,  
Pinner, Middlesex,  
England,

quoting reference NWD/INFRA/19 (Electrical Installation).

3009

## INDIA STORE DEPARTMENT

THE Office of the Chief Engineer, Hydro-Electric Construction Projects, Post Bag No. 60, Bangalore, 1, India, invites tenders for:—

### TENDER ENQUIRY

No. HCP/SVHEP—8/OCT. 1961.

For the supply of 250-volt, 1,000-a.h. capacity Station Battery Banks required for Sharavathi Generating Station and Shimoga and Bangalore Receiving Stations.

A limited number of tender forms are available from the Co-ordination Branch, India Store Department, Bromyard Avenue, Acton, London, W.3, at a cost of £3 15s. per tender enquiry. The cost of the tender documents is not refundable.

Tenders are to be returned direct to the Chief Engineer, Hydro-Electric Construction Projects, Bangalore, 1, India, and not to this office, and should reach him by 2nd January, 1962.

Only the manufacturers (including their constituents or associates authorised to commit them) or their accredited agents who are in a position to supply the requirements from their own or their principal's manufactures are invited to quote.

Specimen copy of the above enquiry can be seen at India Store Department, Engineering Branch, Bromyard Avenue, Acton, London, W.3, under reference S.3572/61/NSC/ENG.2.

3044

## BUNTINGFORD PARISH COUNCIL

### Trunk Road Lighting, A.10

TENDERS are invited for the supply and erection of 18 Concrete or Steel Columns, complete with 140-watt Sodium Lanterns and Lamps.

Specification, with bill of quantities, and form of tender may be obtained from the Clerk of the Council on payment of a deposit of £2, which will be refunded on receipt of a bona fide tender.

Tenders to be submitted to the undersigned in a plain sealed envelope, marked "Trunk Road Lighting," not later than 1st January, 1962.

A. P. WESTOVER,  
Clerk.

Sandon Lane,  
Buntingford, Herts.

3025

## DURHAM COUNTY COUNCIL

TENDERS invited:—

Divisional Police Station and Court House,  
Peterlee—Electrical Installation.

Applications for further details to County Architect, South Street, Durham, not later than 6th December, 1961.

J. T. BROCKBANK,  
Clerk of the County Council.

Shire Hall,  
Durham.

3024

Advertisements are accepted up to first post on Monday of the week of issue

If blocks, bold type or ruled borders are required then on Friday prior to week of issue

All communications to be addressed to:  
Classified Advertisement Department,  
ELECTRICAL REVIEW  
Dorset House, Stamford Street  
London, S.E.1

Original testimonials should not be sent with applications for employment

## POTTERS BAR

### URBAN DISTRICT COUNCIL

Electrical Re-wiring of 50 Council Houses, Cranborne Road

TENDERS are invited for the electrical re-wiring of 50 houses in Cranborne Road, Potters Bar.

Conditions of contract and drawings may be inspected and copies of the specification and form of tender can be obtained from the office of the Engineer and Surveyor, Wylyotts Manor, Darks Lane, Potters Bar, Middlesex, on receipt of a deposit of £2 2s., which will be refunded on the return of a bona fide tender and the relevant documents. Sealed tenders are to be submitted in the envelope provided and bearing no identification of the tenderer, and endorsed "Tender for Electrical Re-wiring, Contract No. 1," must be delivered to the undersigned not later than 12 noon on Friday, 8th December, 1961.

The Council does not bind itself to accept the lowest or any tender.

W. A. STEVENS,  
Clerk of the Council.

Council Offices,  
Darks Lane,  
Potters Bar, Middlesex.

3008

## COUNTY BOROUGH OF HASTINGS

### New Grammar School, Parkstone Road

ELECTRICAL Contractors desirous of tendering for the electrical installation at the above are invited to submit their names to E. O. Baxter, M.Eng., A.M.I.C.E., Borough Surveyor, 37, Wellington Square, Hastings, together with a deposit of three guineas (returnable after the receipt of a bona fide tender), not later than 10 a.m. on Monday, the 4th December, 1961.

Tender documents will be forwarded to applicants immediately they become available.

N. P. LESTER,  
Town Clerk.

Town Hall, Hastings,

3023

## INDIA STORE DEPARTMENT

THE Director General of India Store Department, Government Building, Bromyard Avenue, Acton, London, W.3, invites tenders for the supply of:—

Ref. No. 16070/61/BMB/HAL.3.

Aircraft Plugs, Sockets and Electrical Accessories.

The tender forms with schedules and specifications, which are returnable on 18th December, 1961, may be obtained from the above office (C.D.N. Branch) on payment of a fee of ten shillings (not returnable) for each tender.

The applications for tenders should clearly state the above reference number.

A.I.D./A.R.B. approved firms only need apply.

3043



**Official Notices (continued)****COUNTY BOROUGH OF NORTHAMPTON**

**C**ONTRACTORS wishing to tender for the electrical rewiring of the Racecourse Pavilion, Northampton, should apply to the Borough Architect, Guildhall, Northampton, immediately.

Tenders due in by 20th December.

C. E. VIVIAN ROWE,  
Town Clerk.  
2991

**SITUATIONS VACANT**

(See "Replies to Box Numbers" on page 101)

**SOUTHERN ELECTRICITY BOARD****Third Assistant Engineer (Planning)**

Sub-Area Office of No. 2 (Newbury) Sub-Area. Salary N.J.B. Class M, Grade 10 (£1,275-£1,410 per annum). N.J.B. conditions of service.

The duties of the post will be to assist in the Planning Section principally on the detailed planning of, and scheduling of equipment for, major substations. Applicants should possess suitable technical qualifications.

Applications on forms obtainable from the Sub-Area Secretary, 7, Oxford Road, Newbury, Berks., and returned to him, quoting Z.1437, not later than 4th December, 1961.

**Assistant Engineer  
(Substation Maintenance)**

Bournemouth District of No. 4 (Bournemouth) Sub-Area. Salary N.J.B. Class J, Grade 9 (£1,115-£1,245 per annum). N.J.B. conditions of service.

The duties of the post will be to assist with the maintenance of plant and equipment at outdoor and indoor substations on both urban and rural systems and to undertake standby duties. Candidates should have experience of the commissioning and maintenance of plant and equipment up to and including 33 kV. The possession of suitable technical qualifications will be an advantage.

Applications on forms obtainable from the Sub-Area Secretary, 1, Priory Road, Bournemouth, Hants, and returned to him, quoting Z.1438, not later than 4th December, 1961.

**Assistant Engineers  
(Substation Maintenance)  
(Two vacancies)**

Southampton District of No. 4 (Bournemouth) Sub-Area. Salary N.J.B. Class H, Grade 9 (£1,040-£1,165 per annum). N.J.B. conditions of service.

The successful candidates will be required to assist with the maintenance and operation of overhead and underground distribution systems up to and including 33 kV. Applicants should possess technical qualifications to at least H.N.C. level and should have had sound experience in the commissioning and maintenance of switchgear, transformers, protective systems and ancillary apparatus in a large industrial area. Standby duties will be involved.

Applications on forms obtainable from the Sub-Area Secretary, 1, Priory Road, Bournemouth, Hants, and returned to him, quoting Z.1440, not later than 4th December, 1961.

**Assistant Engineer  
(Maintenance and Operation)**

Greenford District of No. 1 (Southall) Sub-Area. Salary N.J.B. Class H, Grade 10 (£1,015-£1,140 per annum, inclusive of London allowance). N.J.B. conditions of service.

The duties of the post will be to assist with the maintenance and operation of switchgear, transformers, cables and overhead lines up to and including 11 kV. The appointment will involve standby duties.

Applications on forms obtainable from the

Sub-Area Secretary, 2/6, Windmill Lane, Southall, Middlesex, and returned to him, quoting Z.1434, not later than 4th December, 1961.

**General Assistant Engineers  
(Two vacancies)**

Bournemouth District of No. 4 (Bournemouth) Sub-Area. Salary N.J.B. Class J, Grade 12 (£890-£1,015 per annum). N.J.B. conditions of service.

Applicants should have had sound experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution mains and substations. The possession of suitable technical qualifications would be an advantage. The successful candidates will be required to carry out standby duties if and when called upon to do so.

Applications on forms obtainable from the Sub-Area Secretary, 1, Priory Road, Bournemouth, Hants, and returned to him, quoting Z.1439, not later than 4th December, 1961.

**General Assistant Engineers  
(Two vacancies)**

Southampton District of No. 4 (Bournemouth) Sub-Area. Salary N.J.B. Class H, Grade 12 (£825-£940 per annum). N.J.B. conditions of service.

The successful candidates will be required to assist principally with the maintenance and operation of H.V. and L.V. overhead and underground distribution systems up to and including 33 kV. Applicants should preferably possess suitable technical qualifications and sound experience in electricity supply distribution. Experience in the mains work associated with D.C. to A.C. change-over and voltage standardisation would be an advantage. Standby duties will be involved.

Applications on forms obtainable from the Sub-Area Secretary, 1, Priory Road, Bournemouth, Hants, and returned to him, quoting Z.1441, not later than 4th December, 1961.

**General Assistant Engineer**

Weymouth District of No. 4 (Bournemouth) Sub-Area. Salary N.J.B. Class F, Grade 11 (£765-£870 per annum). N.J.B. conditions of service.

The duties of the post will be to assist in the maintenance and operation of the District's distribution network. The successful applicant will be required to undertake standby duties. Applicants should have had sound experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution mains and substations. The possession of suitable technical qualifications would be an advantage.

Applications on forms obtainable from the Sub-Area Secretary, 1, Priory Road, Bournemouth, Hants, and returned to him, quoting Z.1442, not later than 4th December, 1961.

**General Assistant Engineers**

Construction Section, Sub-Area Engineering Department of No. 3 (Portsmouth) Sub-Area. Salary N.J.B. Class L, Grade 17 (£715-£805 per annum). N.J.B. conditions of service.

The duties of the post will be to assist with the installation and erection of plant, equipment and overhead lines, the laying of cables and other constructional work on all distribution systems, up to and including 33 kV.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him, quoting Z.1426, not later than 4th December, 1961.

The successful candidates for the above appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible.

3031

**CLASSIFIED ADVERTISEMENTS  
ARE PREPAID****Eastern Electricity**

Suffolk Sub-Area  
(230/61.R)

IPSWICH DISTRICT

**SENIOR DEMONSTRATOR.**

Applicants should have had a sound training in domestic science and hold a recognised diploma. They should be capable of arranging and giving talks on domestic electrical subjects to women's organisations, school authorities and groups of students.

The duties of the post will include the supervision of staff and to assist in building the domestic load by studying new household techniques and new electrical appliances and by helping housewives directly and indirectly to select, buy and use efficiently the appliances most suited to their needs.

Salary N.J.C. 2, £700-£775.

Apply by letter to R. A. Jackson, Esq., A.M.I.E.E., A.M.B.I.M., Manager, Ipswich District, Eastern Electricity Board, Electric House, Ipswich, Suffolk, by 4th December, 1961.

Northmet Sub-Area  
(241/61.R)

**GENERAL ASSISTANT ENGINEER**

(Engineering Daughterman),  
Civil Engineering and Building Section,  
Sub-Area Engineer's Dept. (Ref. 1093).

Candidates should be capable of preparing plans, estimates and detailed drawings associated with civil engineering and building works. Possession of an Ordinary National Certificate or equivalent qualification is desirable.

Salary N.J.B. Class N, Grade 18 (£815-£920) including London allowance.

Apply by letter to the Manager, Eastern Electricity Board, Northmet Sub-Area, Northmet House, Southgate, London, N.14, by 8th December, 1961.

Chilthorns Sub-Area  
(240/61.R)

**FOURTH ASSISTANT ENGINEER,  
Northwood District.**

Candidates should have had a sound technical training and experience in the construction, operation and maintenance of H.V. and L.V. underground systems, including substations.

Salary N.J.B. Class G, Grade 11, £875-£990, including London allowance.

Apply by letter to the Manager, Northwood District, Eastern Electricity Board, 1, Love Lane, Pinner, by 8th December, 1961.

Chilthorns Sub-Area  
(242/61.R)

**THIRD ASSISTANT ENGINEER,  
Bedford District.**

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems including substations.

Salary N.J.B. Class G, Grade 9, £965-£1,090.

Apply by letter to the Manager, Bedford District, Eastern Electricity Board, Prebend Street, Bedford, by 8th December, 1961.

3022

**OVERHEAD TRANSMISSION  
LINE ENGINEERS**

**L**ARGE contracting organisation has vacancies for AGENTS, SUB-AGENTS and ENGINEERS on 275-kV and 132-kV steel tower and wood pole line contracts in Scotland.

State age and give full particulars of experience to Box 577, Keith & Co., 11, Castle Street, Edinburgh.

2935



## SOUTH EASTERN ELECTRICITY BOARD

INSTALLATION INSPECTOR,  
Crawley and Horsham District.

Wages 5s. 11½d. per hour for a 42-hour week under N.J.I.C. Agreement. Applicants should have a knowledge of the "Regulations for the Electrical Equipment of Buildings" of the Institution of Electrical Engineers and be able to inspect, test and connect all classes of installations; to attend to technical meter queries, and to take maximum demand readings; to attend to pressure complaints and location of earth faults. Subject to certain conditions, housing accommodation may be available at Crawley.

Applications, quoting ER, and naming two referees, to District Manager, SEEBOARD, 50-52, The Broadway, Crawley, by 4th December, 1961.

ELECTRICAL FITTER,  
Brighton and Hove District.

Wages 5s. 6½d. an hour under N.J.I.C. Agreement for 42-hour 5-day week. Optional superannuation scheme after 2 years' service. Applicants should be experienced in the erection and maintenance of H.V. and L.V. switchgear, transformers and associated gear.

Applications, quoting ER and naming two referees, to District Manager, SEEBOARD, Electric House, Castle Square, Brighton, 1, by 4th December, 1961.

SALES REPRESENTATIVE,  
Eastbourne District.

Salary under N.J.C. Grade 1, £600 × £25 to £700 per annum. Superannuable. Applicants should have knowledge of domestic electrical appliances together with experience in selling and dealing with consumers' enquiries. Possession of E.D.A. Salesmanship Certificate would be an advantage. Duties include taking part in sales development and canvassing at consumers' premises. Successful applicant will be required to carry out duties in any Eastbourne District showroom when necessary.

Applications, quoting ER and naming two referees, to District Manager, SEEBOARD, Electric House, Grove Road, Eastbourne, by 6th December, 1961.

DEMONSTRATOR,  
Tunbridge Wells District.

The successful applicant will be required to carry out demonstrations, advise consumers in their homes, instruct school children in the use and care of all types of electrical equipment. Possession of qualifications an advantage. The post offers good opportunities for early promotion to more senior work and salary. Salary in the range £600 to £700 per annum under N.J.C. Grade 1. Superannuable.

Applications, quoting ER and naming two referees, to District Manager, SEEBOARD, Town Hall, Tunbridge Wells, by 6th December, 1961.

GEORGE WRAY,  
Secretary.

3034

GESTETNER LIMITED  
Tottenham, London, N.17

require an

ASSISTANT  
ELECTRICAL ENGINEER

to take charge of Electrical Maintenance Department in their North London factory. Electrical consumption 2,500 kVA.

Applicants should be about 35 years of age and hold the H.N.C. in Electrical Engineering.

Applications to the Personnel Officer, Gestetner Limited, Fawley Road, Tottenham, London, N.17, or telephone TOTtenham 1050.

2925

## CENTRAL ELECTRICITY GENERATING BOARD

## SOUTHERN PROJECT GROUP

## Bankside Power Station

Applications are invited from suitably qualified and experienced engineers for the post of

## THIRD ASSISTANT ENGINEER (MECHANICAL)

at Bankside Power Station Construction Site.

The successful candidate will be required to assist the Site Mechanical Engineer in the supervision of the installation and testing of mechanical engineering plant. Experience in the supervision of construction of major engineering works and in the installation of power station plant would be an advantage.

The salary will be within Scale 13 of the National Joint Board Agreement, i.e., £1,320 to £1,610 per annum, plus £60 London Allowance according to qualifications and experience.

Applications stating age, qualifications, experience, present position and salary should be forwarded to the Administrative Officer, Central Electricity Generating Board, Southern Project Group, Squires Lane Finchley, London, N.3, to arrive not later than Monday, 4th December, 1961.

Envelopes should be marked "Confidential — ref: S/61/27"

T. YULE, Chief Project Engineer

3000

INSPECTOR OF WORKS  
(ELECTRICAL)

required by UGANDA GOVERNMENT Public Works Department. Appointment on contract for 1 tour of 21-27 months in first instance. Salary according to age and experience in scale (including inducement pay) rising to £1,671 a year. Gratuity 25% of total salary drawn. Outfit allowance £30. Children's education allowances. Free passages. Liberal leave on full salary.

Candidates should be 29-40 years of age and must possess at least O.N.C. (Electrical) or equivalent qualification. They should also have served a full apprenticeship and had subsequent experience in maintenance of industrial electrical equipment and large installations. They must be fully conversant with U.K. Home Office Electricity Rules, Electricity Regulations under the Factories Act and those of the Electrical Commissioners.

Apply to CROWN AGENTS, 4, Millbank, London, S.W.1, for application form and further particulars, stating age, name, brief details of qualifications and experience, and quoting reference M2/50987/EG.

2989

NORTH WEST METROPOLITAN  
REGIONAL HOSPITAL BOARD

MAIN GRADE ENGINEER (Electrical) required. Applicants should be A.M.I.E.E. but graduate members will be considered provided they have passed the Institution Examination of the Institution of Electrical Engineers.

The post is permanent and superannuable. The Board operates a scheme of financial assistance for those studying for approved professional qualifications.

Salaries will be within the range of £950 to £1,650. It is possible for corporate members to enter at a salary point up to a maximum of £1,350 and graduate members at a point up to a maximum of £1,255, in respect of years of relevant experience since completing the appropriate Institution's examination.

Apply, stating age, qualifications (with dates) and experience, with the names of two referees, to the Secretary, North West Metropolitan Regional Hospital Board, 40, Eastbourne Terrace, London, W.2, quoting reference 999, by 4th December.

2993

COUNTY BOROUGH OF BURTON UPON  
TRENT EDUCATION COMMITTEE

## Technical College

Principal: E. White, M.Sc.(Econ.)

APPLICATIONS are invited for the post of GRADE B ASSISTANT in the Engineering Department. The teacher required should be qualified to take courses (i) in Electrical Installation and (ii) for Electrical Technicians.

Salary will be in accordance with the Burnham Technical Scale (at present £700-£1,150 per annum). Additions may be given for industrial experience after 21 years of age (up to £330 above the minimum), training and study (up to £120 above the maximum), qualifications (up to £165 above the maximum).

Forms of application, which may be obtained from the undersigned upon receipt of a stamped addressed foolscap envelope, should be sent as soon as possible to the Principal, The Technical College, Burton upon Trent.

A. H. BLAKE,  
Director of Education.

Education Office,  
Guild Street,  
Burton upon Trent.

2987

CENTRAL ELECTRICITY  
GENERATING BOARD

## West Midlands Division

SHIFT CHARGE ENGINEER is required at Hams Hall "B" Power Station, near Birmingham. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade K.6, £1,440-£1,610 per annum, plus 10% shift allowance.

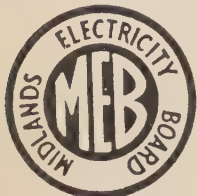
A sound technical training and practical experience in the operation and maintenance of steam generating plant and main switchgear in a large modern power station are required, also a knowledge of P.F. firing. The station is one of advanced design. Appropriate qualifications an advantage.

Apply, quoting Vacancy No. 276/61 MR, on form AE6, available from the Station Superintendent, Hams Hall Power Station, Lea Marston, Sutton Coldfield, Warks., by 4th December, 1961.

3027



## Situations Vacant (continued)



## MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:—

### Birmingham Area

**ENGINEERING DRAUGHTSMAN**  
(General Assistant Engineer)  
(Area Office).

Applicants should have experience in the preparation of drawings in connection with the layout of high-voltage and medium-voltage switchgear, cables, etc., and preparation of mains records for an extensive high-voltage and medium-voltage overhead and underground distribution system. Salary within the ranges £765/£870, £825/£940, £890/£1,015, £965/£1,090, £1,040/£1,165 per annum (N.J.B. Grades N.18 to 14), according to qualifications and experience.

Apply by letter within 7 days, stating age, experience, qualifications, present position and salary, to Enil Braathen, Area Manager, Midlands Electricity Board, 14, Dale End, Birmingham, 4.

### South Staffs. and North Worcs. Area

**SECOND ASSISTANT DISTRICT  
ENGINEER (Dudley).**

Applicants should have had experience in all branches of District work, including the installation, operation and maintenance of high and low-tension cables, switchgear and transformers. Technical qualifications desirable. Salary £1,190/£1,325 per annum (N.J.B. Grade H.7).

Apply by letter within 10 days, stating age, qualifications, experience, present position and salary, to Mr. D. Holt, Acting Area Manager (Ref. EMI/SEC), Midlands Electricity Board, P.O. Box No. 9, Toll End Road, Tipton, Staffs.

### Worcestershire Area

**THIRD ASSISTANT DISTRICT  
ENGINEER (Evesham).**

Experience necessary in all branches of distribution work, including construction, maintenance and operation of high and low-voltage underground and overhead systems and substations. Technical qualifications desirable. Salary £890/£1,015 per annum (N.J.B. Grade F.9).

Apply by letter within 14 days, stating age, experience, present position and salary, to District Manager, Midlands Electricity Board, 64, High Street, Evesham.

F. W. CATER,  
Secretary.  
3012

### ASSISTANT CHIEF ENGINEER

required on a 7,000-t.p.m. gold mine in GHANA having its own 6.6-kV diesel power station. Responsibilities would embrace power generation and all maintenance work in power station, mine and reduction plant.

The contract is continuous with three months' leave on full pay after each tour of 15 months.

The company provides free accommodation, pays the passage outwards and homewards, and operates a provident fund.

Applications stating age, experience and salary expected to the Secretary, Konono Gold Mines Ltd., 49, Moorgate, London, E.C.2.

3038

Applications are invited from

## ELECTRICAL ENGINEERS

for posts leading to senior technical management in a progressive organisation.

Applicants, preferably under the age of 30, should possess an engineering degree. Successful candidates will be trained for responsible executive positions.

The electrical engineers will work as members of teams of technologists who have responsibility for design, construction and operation of large industrial plants and power stations. Thus opportunities exist for electrical engineers to widen their experience in other fields of engineering.

Applications to—Box 2988.

### SCULL ELECTRICAL LIMITED

require

## SENIOR ELECTRICAL ENGINEER

This is a new post and the successful applicant will be responsible for a team of assistants within a growing department. Applicants should have served an apprenticeship in electrical contracting and have wide experience in the preparation of designs, specifications and competitive estimates for electrical installations up to £100,000 in value.

## SENIOR CONTRACTS ENGINEER

Applicants should have served an apprenticeship in electrical contracting and have experience of labour control, ordering materials and running contracts up to £100,000 in value. This is a new post to strengthen an expanding contracts department, and excellent opportunities and a car are offered.

Both of these appointments carry an attractive four-figure salary, pension scheme and ample opportunities for advancement in an expanding company.

Applications, which will be treated in strict confidence, to:—

The Managing Director  
**SCULL ELECTRICAL LIMITED**  
Redcliffe House, Bristol, 3

2992

### NORTH WESTERN ELECTRICITY BOARD

**Second Assistant Engineer,  
Sub-Area Commercial Department, Blackburn**

The person appointed will be required to exercise general supervision over the Installation Contracting Sections in the Sub-Area and to assist in industrial and commercial load development. Experience in design and the preparation of specifications and plans for all classes of electrical installations and the supervision of staff and manual workers is essential.

Corporate Membership of the Institution of Electrical Engineers would be an advantage.

Salary scale £1,440/£1,610 p.a., Grade L.7. N.J.B. conditions.

Applications on forms to be obtained from the Manager, No. 5 Sub-Area, North-Western Electricity Board, Jubilee Street, Blackburn, and returned to him by 4th December, 1961.

3016

## MECHANICAL AND ELECTRICAL ENGINEERS

### Opportunities Overseas

**AIR MINISTRY WORKS DEPARTMENT** invites applications from Assistant Mechanical and Electrical Engineers for appointments initially in overseas areas on tours of 2 or 3 years' duration according to location. Completion of tour is followed by duties in U.K. with every opportunity for further tours overseas.

**SALARY** overseas includes **FOREIGN SERVICE ALLOWANCE** which varies according to location and whether single or married. For example, total emoluments in Cyprus at age 25 range at present from £1,316 to £1,766 (single) and from £1,676 to £2,301 (married). Annual increments to age 38 with a special increase of £95 p.a. for fully qualified men after 2 years' service.

**DUTIES** comprise design, construction and maintenance of installations in workshops and on airfields, radar stations and maintenance units, etc.

**QUALS.** At least the qualifying examination for Corporate Membership (or exemption) of the Institution of Electrical Engineers or the Institution of Mechanical Engineers (with appreciable electrical engineering experience) and not less than 2 years' professional experience.

**CONDITIONS.** Expatriation and kit allowances (£85 to £140 approx.). Free passage overseas for self and later for family when accommodation arranged. Free medical and child educational arrangements. 5-day week with paid annual leave initially 4 weeks and 2 days. Paid sick leave within certain limits.

**PROSPECTS.** Appointments are non-pensionable but retirement/resignation gratuity payable after 5 years' or more service. Excellent opportunities of obtaining permanent pensionable post (with all service counting) and of advancement to posts in the higher grades, which number 180 approx. Higher grade salaries vary between £1,456 and £3,715 p.a. and vacancies are, as a rule, filled by promotion of existing staff.

Applicants, who must be natural-born British subjects under 35 years of age, should write to Air Ministry Works Department (W.G.d), Lacon House, Theobalds Road, London, W.C.1. Selection will be by interview in London and certain expenses will be reimbursed.

270

### MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

**FOURTH ASSISTANT ENGINEER** (Planning and Development) required at No. 3 Sub-Area Headquarters, Chester. Salary £890/£1,015 per annum (N.J.B. K/13).

Applicants should have had experience on the designing of H.V. and M.V. distribution networks and associated equipment, and possess suitable technical qualifications.

Appointment subject to medical examination. Pension scheme.

Applications on forms obtainable from the Manager, No. 3 Sub-Area, Merseyside and North Wales Electricity Board, Newgate Street, Chester, must be forwarded not later than 5th December, 1961.

3033

### UNIVERSITY OF BIRMINGHAM

#### Senior Engineer

APPLICATIONS invited from suitably qualified electrical or mechanical engineers to fill this important and interesting post in this expanding university.

Salary Grade I, £1,250 to £1,850.

Further particulars and forms of application from the Chief Engineer, University of Birmingham, Edgbaston, Birmingham, 15, to be returned by Saturday, 9th December, 1961.

3001



## ELECTRO MECHANICAL DESIGN ENGINEER

Applications are invited from qualified electro-mechanical engineers over 30, who have the initiative and drive to lead a development group engaged in the design of electro-magnetic devices and mountings, similar to those applied in modern telecommunications switching systems.

Candidates should have at least 5 years' experience in this class of design work for mass production and competitive consumer markets.

A knowledge of switching systems functions is also desirable.

Qualifications required are an engineering degree or H.N.C. (mechanical) and corporate membership of a recognised institute.

Our Company is well-established in the London area, and offers a permanent career with a good pension scheme and progressive conditions of employment.

A brief outline of qualifications and experience should, in the first instance, be sent in confidence to Box 2985.

### CENTRAL ELECTRICITY GENERATING BOARD

#### North Eastern Region

#### Fourth Assistant Engineer (Section), Transmission Department, Norton Section

APPLICATIONS are invited for the position of FOURTH ASSISTANT ENGINEER (Section) in the Norton Section of the Transmission Department, with headquarters at Norton Switching Station, near Stockton-on-Tees.

The successful applicant will be required to assist in the operation and maintenance of 275-kV, 132-kV and 66-kV overhead lines and substations. Previous training with a large manufacturer of E.H.T. switchgear and transformers is desirable, and experience on maintenance of overhead lines will be an advantage.

Applicants should have had a good general education and possess a Higher National Certificate in Electrical Engineering, or an equivalent qualification.

The salary for the appointment (which is superannuable) will be in accordance with the National Joint Board Agreement, Class K, Grade 9 (£1,050-£1,325 per annum) and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from the Regional Personnel Officer, Central Electricity Generating Board, North Eastern Region, 1, Whitehall Road, Leeds, 1, to whom they should be returned to arrive not later than 9th December, 1961.

3026

### SOUTH OF SCOTLAND ELECTRICITY BOARD

#### Housecraft Adviser

APPLICATIONS are invited for the above superannuable post which will be based on a large showroom to be opened shortly in Glasgow.

Applicants must be fully experienced in public demonstration work, be capable of supervising a large demonstration theatre, and of training young demonstrators. A domestic science qualification and a thorough knowledge of modern electrical appliances are essential. Sales experience will be an advantage, as also will be the E.A.W. Demonstrators' Certificate.

Salary £780/£880 p.a. (N.J.C. Grade 3).

Applications, giving age, experience, qualifications, and quoting reference C.27/61, should be sent to the Secretary of the Board, Inverlair Avenue, Glasgow, not later than 1st December, 1961.

3015

### WORCESTERSHIRE EDUCATION COMMITTEE

#### College of Further Education, Bromsgrove

#### Engineering Department

APPLICATIONS are invited from suitably qualified persons for the following full-time appointment, to start as soon as possible:—

ASSISTANT LECTURER, Grade B, to teach electrical engineering subjects in Electrical Trades and Mechanical Engineering courses; Principles of Electricity is offered as an endorsement subject in Mechanical Engineering courses.

Teaching experience, though an advantage, is not essential. The salary will be in accordance with the revised Burnham Salary Scales, Grade B, £770 × 16 increments to £1,350.

Application forms may be obtained from the County Education Officer (T5), County Education Office, Castle Street, Worcester, on receipt of a stamped addressed foolscap envelope (T.174).

3014

### CENTRAL ELECTRICITY GENERATING BOARD

#### ASSISTANT ENGINEERS

required in the Regional Offices of the Production, Inspection and Test Section of the Design and Construction Department.

(A) MECHANICAL ENGINEER, London Regional Office.

(B) ELECTRICAL ENGINEER, Birmingham Regional Office.

The section is concerned with the production inspection and testing in manufacturers' works of mechanical and electrical plant and equipment required for generation (including nuclear) and transmission purposes.

Candidates should preferably have qualifications equivalent to Graduate Membership of the Institutions of Mechanical or Electrical Engineers. Recent experience in production control methods and inspection and testing of plant in manufacturers' works is desirable.

Salaries on scales within the range £1,155-£1,610 per annum, plus London allowance where appropriate.

Applications stating age, qualifications, experience, present position and salary to the Appointments Officer, 24/30, Holborn, London, E.C.1, by 11th December. Quote ref. ER/513.

2986

### LONDON ELECTRICITY BOARD

#### Engineer (Test), Meter and Test Branch, Chief Engineer's Department

APPLICATIONS are invited for the above position at Lesco House, Stamford Street, London, S.E.1.

Duties include statistical and experimental investigations into protective gear performance and assisting in the development of schemes and apparatus for special applications.

Applicants should have had a sound general and technical education, a wide experience of general testing, and be familiar with all the usual calculations involved in general protection work. Some knowledge of electronics would be an advantage.

The post is graded under Schedule A of the National Joint Board Agreement, Class K (Area) as Grade 6, £1,380/£1,670 per annum inclusive of London allowance.

Application forms from the Personnel Officer, 46, New Broad Street, London, E.C.2. Please quote ref. PER/V/3467/R.

3013

## DRAUGHTSMEN

seeking scope for their initiative and ability will find interesting work at

### FOSTER TRANSFORMERS LIMITED

The company's diverse range of products includes transformers of all types, voltage regulators and control equipment.

Apply to the

Personnel Officer

FOSTER TRANSFORMERS LTD.

Morden Road, South Wimbledon

London, S.W.19

A Company of the Metal Industries Group

3036

### L.C.C. SOUTH EAST LONDON TECHNICAL COLLEGE

Lewisham Way, London, S.E.4

#### Department of Electrical Engineering and Applied Physics

SENIOR LECTURER required in Electrical Engineering. Candidates should be well qualified and have had good industrial experience.

Successful candidate required to teach up to I.E.E. Part III in one or more of the special subjects. Approved research encouraged.

Salary (subject to ratification) £1,845-£2,060.

Forms from Secretary, quoting (FE.3a/R/2977/11), returnable within two weeks.

2994

### BRITISH ENGINE BOILER & ELECTRICAL INSURANCE CO. LTD.

Longridge House, Manchester, 4

ELECTRICAL SURVEYORS required in England and Scotland. Permanent positions carrying progressive salary scale £825 to £1,225 with non-contributory pension. Candidates, aged 26 to 32, with H.N.C. in Electrical Engineering or Grad. I.E.E., and with apprenticeship in manufacture or repair of electrical machinery, are invited to apply stating age, qualifications and experience.

2999



## Situations Vacant (continued)

**FREDERICK S. SNOW & PARTNERS****Consulting Engineers**

invite applications from Electrical Engineers to work on a wide range of industrial and commercial projects in their Electrical and Mechanical Department.

Applicants should preferably have practical experience in electrical installation design in buildings, and hold National Certificate or equivalent qualifications.

The organisation has a superannuation scheme and luncheon voucher facilities.

Details of education, training, age and experience should be sent in confidence to:—

Ross House, 144, Southwark Street  
London, S.E.1

3010

**SOUTH OF SCOTLAND  
ELECTRICITY BOARD****Demonstrator**

APPLICATIONS are invited for the above superannuable position in a large showroom to be opened shortly in Glasgow.

Applicants must be experienced in presenting public demonstrations and capable of assisting the Senior Demonstrator in supervising the theatre and training staff. A knowledge of electrical appliances is necessary, as also is a domestic science qualification. Sales experience will be an advantage.

Salary £600/£700 per annum.

Applications giving age, details of experience, qualifications, etc., and quoting reference C.28/61, should be submitted to the Secretary, South of Scotland Electricity Board, Inverlair Avenue, Glasgow, S.4, not later than 1st December, 1961.

3032

**NORRIS CONSULTANTS LIMITED**

require in the Bristol and Reading offices

**ELECTRICAL ENGINEERS.****ELECTRICAL  
DESIGNER/DRAUGHTSMEN.**

Applications are invited from engineers and draughtsmen with experience in building installations, distribution and control equipment.

Send full details, quoting reference M.R.N., to Beacon House, Queen's Road, Clifton, Bristol, 8.

2914

**TECHNICAL SALES  
REPRESENTATIVE**

REPRESENTATIVE required to be based on our Bristol office and to cover the South-West of England for the sale and application of transformers and of power capacitors. A knowledge of the area and some experience of technical sales are desirable but not essential.

Applications in confidence to:—

Sales Director  
BRYCE ELECTRIC  
CONSTRUCTION CO. LTD.  
Kelvin Works, Hackbridge, Surrey

2888

**SOUTH WESTERN ELECTRICITY BOARD**

APPLICATIONS are invited for the following positions:—

**THIRD ASSISTANT DISTRICT  
COMMERCIAL ENGINEER**  
(Industrial and Commercial Development),  
PLYMOUTH.

Salary within Class H, Grade 9, Salary Scale 8 (£1,040 to £1,165 per annum) of the N.J.B. Agreement.

The successful candidate will be responsible to the First Assistant District Commercial Engineer (Contracting) for industrial and commercial development, with particular reference to the development of thermal storage installations.

A knowledge of heat loss calculations and heating design techniques is essential. Possession of qualifications equivalent to Higher National Certificate in Electrical Engineering is desirable, as is possession of a current driving licence.

Applications to be made on standard form AE6/ACT, OBTAINABLE BY POSTCARD ONLY from the District Manager, South Western Electricity Board, Elliott Road, Prince Rock, Plymouth. Closing date for receipt of completed applications is 9th December, 1961.

3039

**SOUTH WALES SWITCHGEAR LTD.****Blackwood, Mon.**

THE company has a number of vacancies for young men with initiative and preferably a Higher National Certificate or equivalent qualification to undertake design work on high-voltage switchgear and associated equipment.

Previous experience of switchgear design is preferred, but a background of general design experience is considered appropriate for some of the vacancies.

The works are located in pleasant surroundings within easy reach of Cardiff and Newport. Attractive salaries are offered to successful applicants.

Applications stating age, qualifications and experience should be addressed to the Chief Switchgear Design Engineer.

3035

**CENTRAL ELECTRICITY  
GENERATING BOARD****West Midlands Division**

ASSISTANT SHIFT CHARGE ENGINEER is required at Meaford "A" Power Station, near Stone, Staffs. N.J.B. service conditions, superannuable appointment, salary within Schedule A of the Agreement, Grade G.9, £965/£1,090 per annum, plus 10% for shift duties.

Applicants should have received a sound technical training and practical experience in the operation and maintenance of steam generating plant and main switchgear, and a knowledge of P.F. firing is desirable. Appropriate technical qualifications would be an advantage.

Apply, quoting Vacancy No. 272/61 MR, on form AE6, available from the Station Superintendent, Meaford Power Station, near Stone, Staffs., to be completed and returned by 4th December, 1961.

3021

**CROMPTON PARKINSON  
(CHELMSFORD) LTD.**

require a

**SENIOR TEST ENGINEER**

AN experienced man, conversant with the testing of medium sizes A.C. and D.C. machines, is required in our rotating machine test section.

Applications should be sent in confidence to Personnel Officer, Crompton Parkinson (Chelmsford) Ltd., Writtle Road, Chelmsford, Essex.

2972

**MOTOR CONTROL GEAR  
SALES ENGINEERS**

OWING to expansion of the company's activities we have a number of vacancies for TECHNICAL SALES REPRESENTATIVES in the London, Midlands and Northern areas. Applicants should either possess H.N.C. in Electrical Engineering, or equivalent, or have had experience in the field of motor control gear.

Applications giving full details of qualifications and experience should be sent to

The Secretary  
MORECAMBE ELECTRICAL  
EQUIPMENT COMPANY LIMITED  
Westgate Works, Morecambe

2949

**SOUTH WALES ELECTRICITY BOARD****Assistant Engineer**

APPLICATIONS are invited for the position of ASSISTANT ENGINEER in the Pembrokeshire District (Haverfordwest) of the West Wales Area.

Preference will be given to engineers possessing the Higher National Certificate in Electrical Engineering and a sound technical training on overhead and underground H.V. and L.V. systems is desirable.

Salary Class F, Grade 9, Scale 6 (£890/£1,015 per annum).

Applications stating age, present position, present salary, qualifications and experience should be addressed to E. Broughton, A.M.I.E.E., Manager, West Wales Area, South Beach Pavilion, Tenby, to arrive not later than 9th December, 1961.

Please quote reference 143/61/ER, endorsing envelope "Assistant Engineer."

R. G. WILLIAMS,  
Secretary.

3040

**LONDON ELECTRICITY BOARD****General Assistant Engineer**

APPLICATIONS are invited for the above position. Initially, the successful candidate will be located at 255/279, Cambridge Heath Road, Bethnal Green, London, E.2.

Applicants should have a sound technical education to the standard of the Higher National Certificate and have completed a recognised period of training in the electricity industry, or have equivalent experience.

The post is graded under Schedule A of the National Joint Board Agreement, Class K (Area) as Grade 15, £725 to £920 per annum, inclusive of London allowance.

Applications should be sent to the Manager, East End District, 255/279, Cambridge Heath Road, Bethnal Green, London E.2, within 14 days of the publication date of this notice. Please quote ref. PER/V/3436/R.

3029

ESTABLISHED ELECTRICAL DISTRIBUTORS AND WHOLESALE MANUFACTURING AND IMPORTING DIRECT ARE PREPARED TO INTERVIEW AS REPRESENTATIVES MEN WITH ESTABLISHED CONNECTIONS IN THE ELECTRICAL TRADE FOR POSTS IN A COMPANY WITH RAPIDLY EXPANDING SALES.

ALL ENQUIRIES TREATED IN CONFIDENCE.

WRITE GIVING FULL DETAILS—  
BOX 2913.



**W. H. ALLEN SONS & CO. LTD.**

have a vacancy for a

**SALES ESTIMATING AND  
CONTRACTS ENGINEER**

in their

**ELECTRICAL DEPARTMENT**

Candidates should be between 24-35 years old and possess at least an H.N.C. in Electrical Engineering or equivalent. The work will cover proposals involving A.C. and D.C. generators and motors, switchgear and control gear for land and/or marine applications. Salary according to experience and qualifications.

Application forms, etc., can be obtained from:—

**The Personnel Manager**  
(Ref. 507/2/3)  
**Queens Engineering Works**  
**Bedford**

3037

**EXECUTIVE ENGINEERS:  
POST OFFICE**

**PENSIONABLE** posts in London and Provinces for Mechanical, Electrical and Electronic Engineers (Male), at least 21 and normally under 35 on 1st September of the year in which they apply, to develop and design communications systems and postal services.

Qualifications: normally Degree, or Dip.Tech., in engineering or physics or, exceptionally, evidence of very high professional attainment may be accepted in lieu.

Starting salary (Inner London) £762-£1,318 according to age. Scale maximum £1,573. Promotion prospects.

Write Civil Service Commission, 17, North Audley Street, London, W.1, for application form, quoting S/322.

3011

**PRODUCTION ENGINEER**

**QUALIFIED** or trained and experienced engineer, aged 27-40, required to cover the following fields.

Assembly of light industrial electrical equipment including the design of jigs and fixtures and ancillary equipment for modern production methods.

Knowledge of plastic mouldings, die castings, pressing and turned parts an advantage.

This situation is a progressive one with definite opportunities for advancement, carrying a non-contributory pension in an expanding company.

Write in the first instance stating age, details of education, training and appointments held to:—

**The Managing Director**  
**CRAIG & DERRICOTT LTD.**  
**Coleshill Street, Sutton Coldfield**  
**Warwickshire**

3048

**CENTRAL ELECTRICITY  
GENERATING BOARD****North Eastern Region****Regional Electrical Department****Fourth Assistant Engineers (Planning)**

**APPLICATIONS** are invited from suitably qualified engineers for a position as a **FOURTH ASSISTANT ENGINEER** in the System Planning and Development Section of the Regional Technical Branch at Leeds. The successful candidate will be required to assist with system studies employing A.C. and D.C. calculators, and with planning extensions to the transmission system.

The salary for these appointments will be in accordance with the National Joint Board Agreement, Class K, Grade 9, 10 or 11 (£900-£1,325 per annum) according to qualifications and experience.

Forms of application may be obtained from the Regional Personnel Officer, Central Electricity Generating Board, North Eastern Region, 1, Whitehall Road, Leeds, 1, to whom they should be returned to arrive not later than 4th December, 1961.

2982

**A SENIOR** and a junior electrical engineer required in Glasgow by a large organisation for the preparation of drawings, specifications and installation of a wide variety of equipment. Write Chief Engineer, The Distillers Co. Ltd., Engineering Division (North), 64, Waterloo Street, Glasgow, C.2, stating age, experience, qualifications and salary expected.

**ADDITIONAL** supervising engineer for London contractor. One able to run contracts from inception to final accounts and be responsible to manager for same. Only person who has had several years' experience in similar capacity would suit. Good salary and prospects. —Box 106.

**ASSISTANT** diesel electric mechanic, South Georgia, required by Falkland Islands Government for service in South Georgia for one tour of 2 1/2 years in first instance. Salary £540 a year. Gratuity at rate of £10 for each completed month of residential service. Meals, furnished accommodation, fuel and lighting provided free. Liberal leave on full salary. Free passages. Candidates, single and under 40 years of age, must be able to repair and maintain diesel electric (A.C.) generators up to 75 kW and service electrical equipment. Apply to Crown Agents, 4, Millbank, London, S.W.1, for application form and further particulars, stating age, name, brief details of qualifications and experience, and quoting reference M2/51446/EF.

**ASSISTANT** stores manager required. Only first-class applicants with substantial experience in electrical wholesaling will be considered. Above average salary offered in return for ability and efficiency. Permanent superannuated post for right man. Staff canteen. —FULham 3355 (London).

**SST**, branch manager reqrd. by elec. wholesalers, Luton district. Must have good knowledge of the trade and administrative ability. Apply in writing to: Secy., L.E.C., 92, Blackfriars Rd., London, S.E.1.

**BOOK-keeper**, male or female. This is a responsible position and a good salary will be paid. Please state present earnings and when available. References would be required. —Box 107.

**CLERK** for buying department of electrical contractors near Liverpool Street Station, London. Experience of electrical material advantageous. 5-day week. Salary according to age and experience up to £12 p.w. Write giving full details to: Box ER.230, c/o Hanway House, Clark's Place, London, E.C.2.

**CONTRACT** and estimating engineer required by established electrical contractors in the West Country. Experience in all branches of the trade and capable of controlling labour and finalising accounts necessary. Good prospects for the right person. Write with full details of experience, age and salary to: Box 3007.

**CLASSIFIED ADVERTISEMENTS  
ARE PREPAID**

**ELECTRICAL** draughtsman/engineer required by electrical consultants.—Brown & Hooker, 123 Warwick Rd., London, S.W.5. 2790

**ELECTRICAL** engineer/draughtsman required for work on large public buildings, factories, hospitals and schools. Duties include design, estimating and the preparation of specifications for electrical power and lighting installations. Experience in this or similar work is required. Attractive salaries are offered for suitable qualifications and experience.—Box 3003.

**ELECTRICAL** installation contractors in London, W.1, require an experienced estimator. 5-day week, pension scheme, luncheon vouchers. Age unimportant if in good health. Applications to: Box 8392.

**ELECTRICIAN**, well qualified with good experience, required in view of eventual retirement of factory maintenance and installation electrical engineer. Splendid opportunity for first-class man. House available. Apply: Secretary, Anglo-Swiss Screw Co. Ltd., West Drayton, Middx.

**ENGINEER** required, male or female, with experience in production of lighting fittings and electrical installations, to take charge of estimating dept. Pension scheme; 5-day week. Salary according to ability and experience. Apply: Ionlite Ltd., 89, Scrubs Lane, London, N.W.10 (LAD. 2468).

**ESTIMATING**/supervising and/or design and also junior engineer required for progressive positions for high-class installation work in an expanding company. Write in confidence stating age, experience in detail and salary required to: Managing Director, Alliance Electrical, 2, Henrietta St., London, W.C.2. Progressive salary and scope for advancement for able and enthusiastic engineers.

**FOREMAN** required to take complete charge of small winding shop, for production of universal motors suitable for domestic appliances, N.W. London. Applicants must have experience in up-to-date manufacturing techniques. Write giving details of experience and salary required.—Box 3005.

**REPRESENTATIVE**, age not exceeding 30, previous knowledge not essential; must have elementary mathematical ability. Apply to: Managing Director, Standard Wholesale Electrical Co. Ltd., St. Michael's Road, Croydon.

**REPRESENTATIVE** required by well-known rotary switchgear manufacturers to operate in the South-West of England. Previous sales experience not essential providing that the applicant has satisfactory technical training. Commencing basic salary £800 to £850, plus bonus, car and expenses.—Box 3017.

**REPRESENTATIVES** required London and Home Counties to sell a well-catalogued modern range of competitive tungsten lighting fittings to architects, wholesalers, contractors and large users. Salary, commission and expenses.—Box 2979.

**REQUIRED** by old-established firm of electrical engineers and contractors, a contracts engineer for permanent overseas position. Able to take charge of office at manager level. Must have experience of estimating, contract management, administration of U.K. and local labour. Applicants must produce evidence of their experience. Applicants should state completely their experience, salary expected and at least three references. Application should be marked private and confidential, ref. C.E.—Box 2920.

**SENIOR** billing clerk for leading electrical contractor. Full experience of all types of final accounts, interim payments, etc., essential, preferably with large contractor. Pension scheme and free life assurance. 3 weeks' holiday after 3 years. Bonus scheme. Write giving full details and salary required to Box ER.236, c/o Hanway House, Clark's Place, London, E.C.2.

**SENIOR** estimating engineer req., experienced in all types of installation work, capable of controlling labour and handling contracts to final account stage. Good opportunity for right man to become assistant to manager. Write stating details of exp., age and salary to: F. H. Wheeler (Bristol) Ltd., 37, Victoria St., Bristol, 1. 3006

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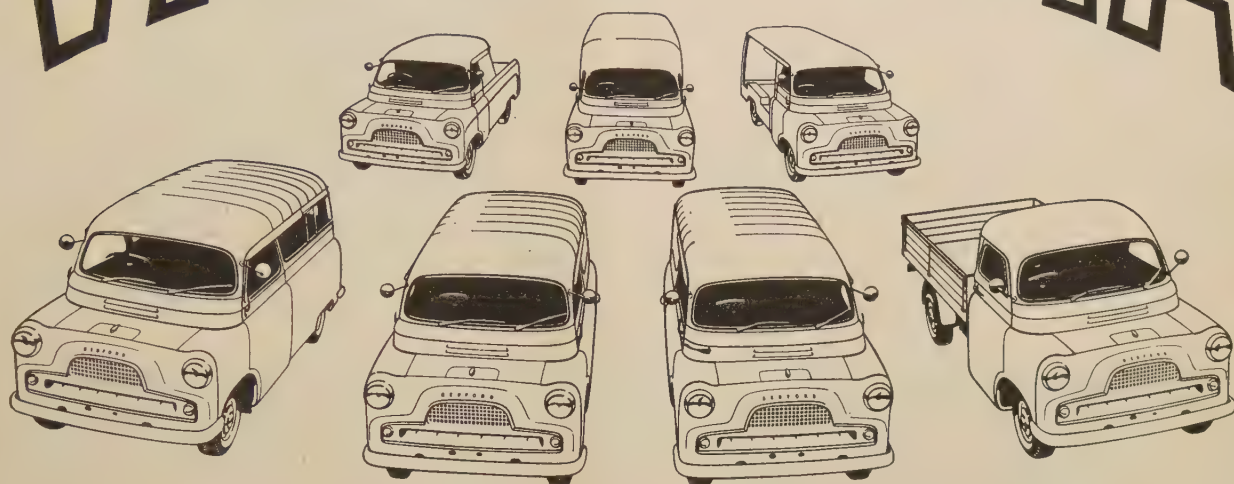
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Crabtree, J. A., & Co. Ltd. ....	60 & 61	Litholite Insulators & St. Albans Mouldings Ltd. ....	96				
Craig & Darriott Ltd. ....	28	Llandaff Engineering Co. ....	23				
Cressall Mfg. Co. Ltd. ....	100	Logan, Walter, & Co. Ltd. ....	73				
Crompton Parkinson Ltd. ....	50 & 113	London Electric Wire Co. & Smiths Ltd. ....	3				
Curtis Mfg. Co. Ltd. ....	72	Lucas, Joseph, Ltd. ....	99				
D.R. Illuminations Ltd. ....	34	Maclaren, Robert, & Co. Ltd. ....	29				
Dacier Ltd. ....	78	Martindale Electric Co. Ltd. ....	71				
Daly (Condensers) Ltd. ....	86	Mek-Elek Engineering Ltd. ....	112				
Donovan Electrical Co. Ltd. ....	114	Metway Electrical Industries Ltd. ....	28				
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Elcordia Ltd. ....	114	New Switchgear Construction Co. Ltd. ....	92				
Electric Elements Co. ....	96	Oliver Pell Control Ltd. ....	94				
Ellison, Geo., Ltd. ....	69	Ormond Engineering Co. Ltd. ....	4				
Eltron (London) Ltd. ....	92						
Enfield-Standard Power Cables Ltd. ....	44						
English Electric Co. Ltd. ....	40, 41 & 68						
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INDUSTRIAL  
LIGHTING  
UNITS

For wall bench or machine mounting. Catalogue sent free on request.

MEK-ELEK Engineering Ltd., MITCHAM  
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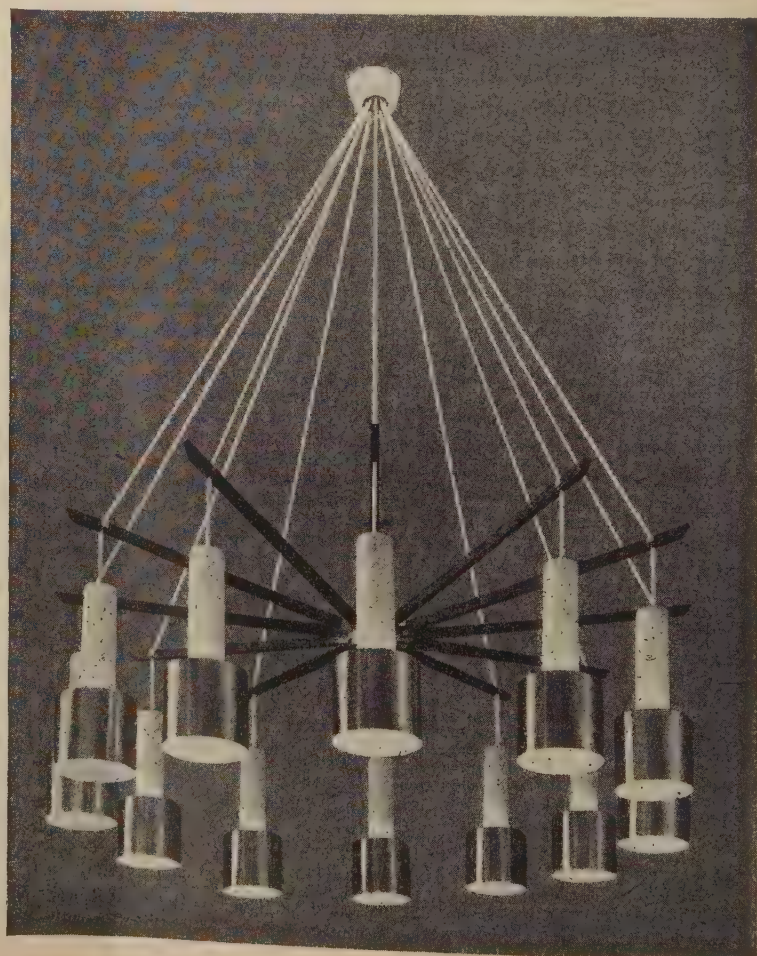
C M C

# Lighting

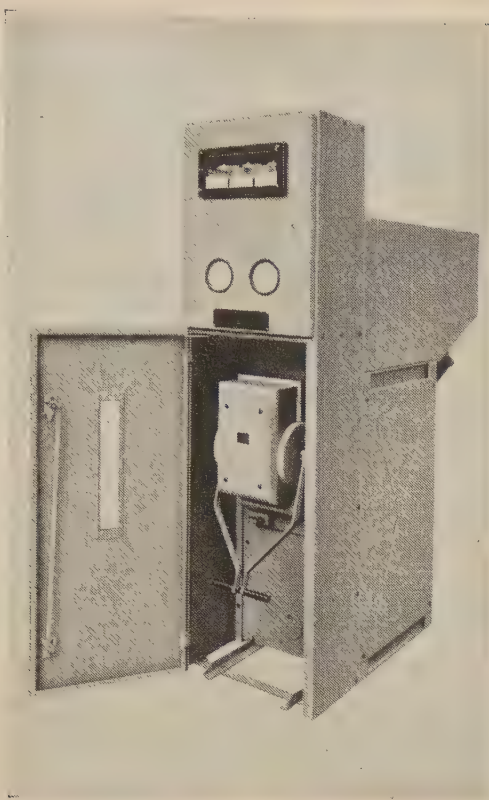
2532D/251. 12 Light Teak Spreader pendant with satin opal glass and brushed copper shades. Diameter 48" overall.

One of a series of interesting new three, six and twelve light pendant fittings available with a selection of five alternative shades. The spacer assemblies are constructed with oiled teak arms, metalwork finishes on the Spacer and Ceiling plate are satin chrome and white stove enamel. The teak spreader range is one of several attractive ranges of Lighting Fittings recently introduced by C. M. Churchouse Ltd. Please write for leaflets giving full information.

C. M. Churchouse Ltd.  
Lichfield Road, Brownhills, Staffordshire  
Telephone. Brownhills 3551-6

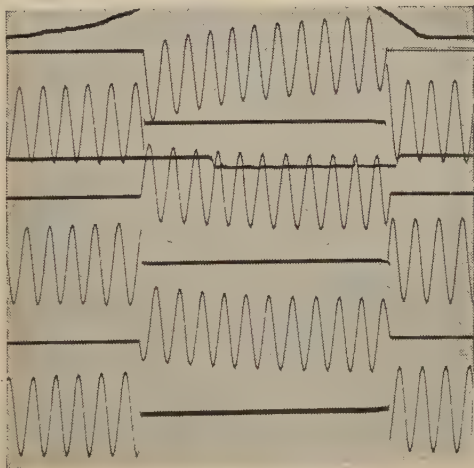






Testing plays a larger part in the development of switchgear than of most plant. And it is not a matter of subjecting a circuit-breaker to a heavy overload to see whether it blows up. On the contrary, to the non-specialist observer a test is an almost ludicrous anti-climax. The build-up is impressive; long preparation, elaborate fire precautions, the switchgear itself as distant as the target in a rifle range and watched through armoured glass. A warning hooter clears the site. Then the test engineer presses a control switch... in complete silence absolutely nothing happens, and the test—another 'shot'—is over. But a battery of oscillographs has recorded on photographic film a complete history of everything of importance that happened inside the switch. This is one approach to...

## This thing called know-how



Any new design or improvement of an existing one involves many such tests of numerous detailed innovations. They are the means by which the designer checks his work as it proceeds. Ready access to test facilities is thus an essential of his work. We are fortunate in having at Chelmsford one of the most up-to-date (ASTA) testing stations in the country, and this has played a most important part in the evolution of all our switchgear. But there is another side to know-how which comes from sheer experience—and we have had 80 years of that.

# Crompton Parkinson

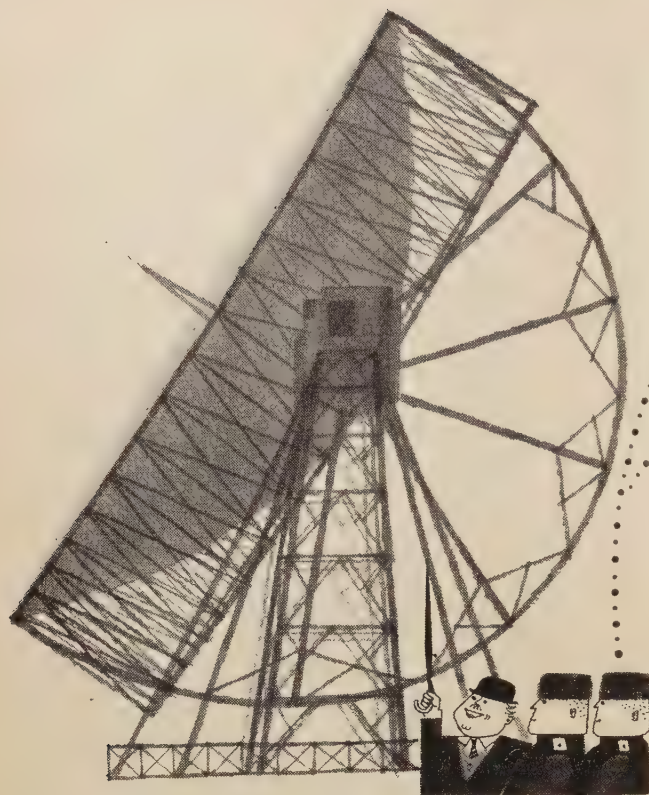
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**CROMPTON PARKINSON LTD., CROMPTON HOUSE, ALDWYCH, LONDON, W.C.2.**





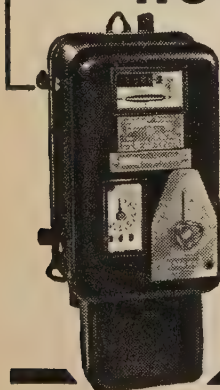
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but we'd like  
to see an  
Elcordia Transformer'*

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These transformers range from 50 VA to 1000 kVA, and both standard and special types are supplied for mining, industrial, and a wide variety of domestic and other purposes.

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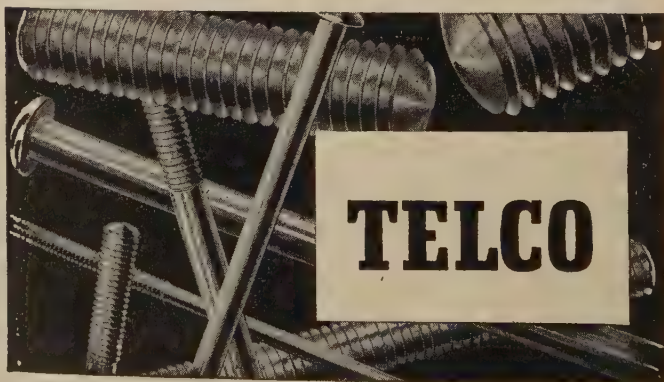
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# DOMESTIC ELECTRICAL EQUIPMENT SUPPLEMENT

# ELECTRICAL REVIEW

FOOD MIXERS  
KETTLES PERCOLATORS  
AND TOASTERS

24  
NOVEMBER  
1961



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and TOP SALES...



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WHISTLING  
KETTLE

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**FAST BOILING**  
Electric Kettles

SWAN BRAND

ELECTRICAL APPLIANCES  
AND GROUND BASE  
ALUMINIUM HOLLOWWARE



# Kenwood Chef

**THE WORLD'S MOST WANTED  
FOOD PREPARATION MACHINE!**



Women want the Kenwood Chef because no other machine has so many attachments—does so many difficult, time consuming and messy jobs for them. It helps with every meal—from a welsh rarebit to a four-course dinner! And once they've bought the basic Chef, they come back again to buy the Chef's

attachments. Widely advertised in the national press, full-colour pages in leading magazines and at your local cinema...the famous Kenwood Chef is always in demand! Kenwood Chef stand pack includes mixing bowl, three beaters, and 126-pages recipe and instruction book. RETAIL PRICE: £24.9.7 + £4.18.5 PT



Everyone wants a

**Kenwood** kitchen!

For full information, and details of generous co-operative advertising terms,

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# DOMESTIC KITCHEN APPLIANCES

## food mixers, kettles, percolators and toasters

Having dealt with the electric cooker in our last survey, we now turn to some of the smaller items of domestic electrical equipment generally used in the kitchen, namely food mixers, kettles, coffee percolators and toasters. Various types of food mixers are now available, ranging from the small portable mixer/beater or whisk to the larger multi-purpose kitchen machines for which there are attachments that provide for a variety of kitchen tasks, including vegetable slicing and shredding, meat mincing, potato peeling, tin opening, etc. There are also drink mixers and liquidisers and machines which serve principally as coffee mills or grinders—all of which come under the general classification of food mixers. On the whole sales this year have been satisfactory and with the improvement expected next month, the sales figures for 1961 are expected to be in the region of 125,000.

Also included in this survey is the electric kettle, a valuable accompaniment to the electric cooker. One of the largest manufacturers is undoubtedly Bulpitt & Sons whose "Swan Brand" range includes all types in sizes from 2 to 6 pints. The most popular electric kettle size is the 3 pint model and the standard loading varies between 1,000 W and 1,500 W. There has, however, been a tendency in the past year or two for the loading to be increased. Kettles fitted with elements rated at 2 kW and even higher are now proving to be quite popular.

The Hotpoint "Hi-Speed" has a loading of 2.6 kW and the Bulpitt "Royal" kettles now include a 3 pint size with a 2,750 W loading and a 4 pint model fitted with a 3 kW element. Most of the models produced by the various manufacturers, apart from individual differences in styling, conform to a more or less standard pattern, the majority being made of aluminium or chromium plated copper. An exception, however, is the electric jug, obtainable from Bulpitt and, more recently, from L. G. Hawkins & Co., Ltd. Apart from heating water, these appliances are also useful for warming milk, soups, etc., or even for making tea or coffee.

Several kettle manufacturers also produce coffee percolators. The total number produced annually is not as great as that for electric kettles, of course, but sales are, however, maintained in the region of 60,000 per year.

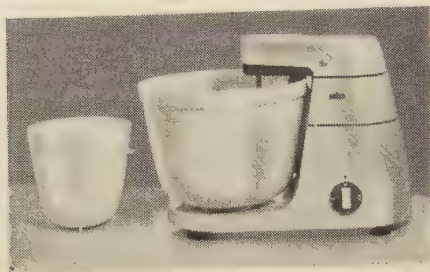
There continues to be a steady demand for the electric toaster and, although sales of this appliance are not spectacular, there is usually an increase at this time of the year as it makes an ideal Christmas gift. Morphy-Richards continue with their successful automatic or "pop-up" toaster and have additionally introduced a further automatic model, type TOS, with a five-position browning control. A model designed on similar lines to this is also now available from H.M.V. Domestic Appliances, Ltd.

### FOOD MIXERS

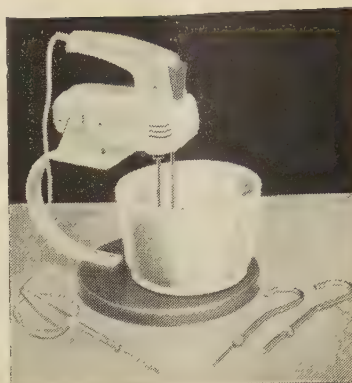
Manufacturer or Distributor	Name or Model	Standard Equipment	Special Features	Finish	Price (excl. P.T.)	Purchase Tax
ANDREWS HOUSEWARE MFRS., LTD., 137, Kirkdale, Sydenham, S.E.26.	"Moulinex" junior beater	Two pairs of blades	Double insulated	Two-tone blue, nylon and plastic	£2 9 1	£0 8 11
	"Moulinex" senior beater	Three sets of blades	Double insulated	Cream, nylon and plastic	£3 6 6	£0 12 0
	"Moulinex" junior grinder	Self-contained	Double insulated	Ivory/red, ivory/blue or ivory/yellow	£1 13 6	£0 6 0
	"Moulinex" senior grinder	Self-contained	Double insulated	Pale blue	£2 9 1	£0 8 11
	"Moulinex" liquidiser grinder	Self-contained	—	Cream	£3 11 0	£0 13 0
	"Moulinex" mincer and grater	Three graters and shredders, one slicer	Double insulated	Cream	£6 13 5	£1 4 1
	"Moulinex" "Robot Marie"	Dough hooks, mixing bowl, potato masher, pan scourer	Double insulated all-purpose mixer	Cream	£7 12 6	£1 17 6
	"Moulinex" "Robot Charlotte"	Graters, shredders, fruit squeezing attachment	Double insulated	Cream	£10 13 3	£1 18 9
BERRY'S ELECTRIC MAGICOAL, LTD., Newman Street, London, W.1.	"Magicmaid" KM3	Two bowls, whisk and dough hook, spatula	Ease of fitting attachments	White "Polyamide," blue trim	£24 4 0 £33 7 6 (with mixer, blender and shredder)	£4 17 4 £6 14 2
	"Multimix" MX3	Blender	Ease of fitting attachments	White "Polyamide," blue trim	£14 7 0	£2 17 9
	"Multipress" MP3	Spatula	Compact and portable	White "Polyamide," blue trim	£14 7 0	£2 17 9
"Magicmaid" and "Multimix" accessories:—Blender, £4 11s 2d (plus 9s 2d purchase tax); shredder, £7 15s 3d (15s 10d); coffee grinder, £2 9s 11d (5s); juice extractor, £2 14s 6d (5s 6d); mincer, £10 1s 1d (£1 0s 3d).						



## FOOD MIXERS (continued)



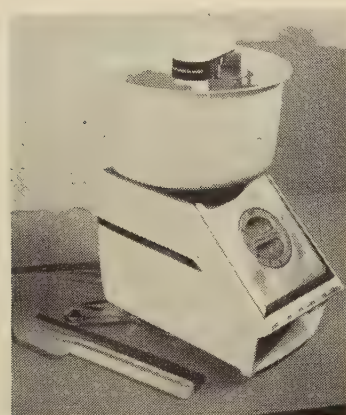
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1. Berry's Electric "Magicmaid" food mixer
2. Bylock food mixer
3. S. N. Bridges "Luxury Life" food mixer
4. E. A. Cannon "Power-Maid" portable multi-purpose unit
5. English Electric food mixer

Manufacturer or Distributor	Name or Model	Standard Equipment	Special Features	Finish	Price (excl. P.T.)	Purchase Tax
<b>BOSCH, LTD.,</b> 205, Great Portland Street, London, W.1.	"Bosch" mixer	Enamelled bowl with mixing arm, wooden pestle, 3 pt mixing goblet	Fully insulated, stainless steel mixing bowl and wide range of attachments available	White, black fittings	£35 3 1	£7 0 5
<b>BRATTEL ELECTRIC CO., LTD.,</b> 1-9, Dover Yard, Berkeley Street, London, W.1.	"Beekay" kitchen machine	Motor unit and mixer, kneader attachment, 8 pt bowl	Various attachments available (see below)	White	£22 3 10	£4 9 3
"Beekay" kitchen machine accessories:—Vegetable slicer/shredder, £5 16s 10d (plus 11s 9d purchase tax); liquidiser, £3 13s 4d (7s 4d); grinder, £1 14s 4d (3s 5d); meat and vegetable mincer, £5 6s (10s 11d); fruit squeezer, £1 18s 11d (3s 11d).						
<b>S. N. BRIDGES &amp; CO., LTD.,</b> York Road, Battersea, London, S.W.11.	"Luxury Life"	Whisk, beater, mincer and coffee grinder	Attachments easily interchanged, 100 page recipe book	White and chromium	£7 17 5	£1 11 7
<b>BYLOCK ELECTRIC, LTD.,</b> South Street, Enfield, Middlesex.	"Bylock"	Twin beaters, twin dough hooks, whisk, stand and bowl	Three-speed control, portable or on stand	Ivory and red	£9 1 3	£1 16 5
<b>CANNON, E. A.,</b> Deepfields, Bilston, Staffs.	Cannon "Power-Maid"	6-speed power unit	Built-in model: fits flush with working surface, recessed multi-speed switch and power drive. Portable model also available	Built-in model: stainless steel top plate. Portable model: stainless steel top and base with white vitreous enamel housing	£16 1 9 (built-in) £17 15 1 (portable)	£3 4 9 £3 11 5
Accessories:—Food mixer, £6 18s 4d (plus 13s 11d); blender, £2 16s 10d (5s 8d); knife sharpener, £1 15s 7d (3s 7d); juicer, £1 7s 11d (2s 10d); coffee mill, £2 7s 0d (4s 9d); citrus fruit juicer, £1 2s 11d (2s 4d); potato peeler, £5 0s 9d (10s 2d); high speed juicer, £4 2s 6d (8s 3d); mincer, £3 15s 7d (7s 7d); slicer/shredder, £3 17s 11d (7s 10d); adaptor, £4 11s 2d (9s 2d).						
<b>ENGLISH ELECTRIC CO., LTD.,</b> East Lancashire Road, Liverpool, 10.	"5500"	Two clip-in beaters, turntable and two ridged bowls	Portable mixer head, 20-speed control dial	Cream or white, candy pink, aquamarine, and lavender grey	£15 10 0	£3 2 4
Accessories:—Mincer, £5 17s 1d (plus 10s 9d purchase tax); juice extractor, £2 9s 1d (4s 6d).						
<b>HILLMAN ELECTRIC MOTORS, LTD.,</b> Eastern Works, Eastern Avenue, Romford, Essex.	"Hillma-mix"	Liquidiser/grinder	Portability	White with red base	£7 10 6	£1 9 6
	"Hillman"	Kitchen and coffee mill	—	Cream	£2 17 6	£0 11 6



# They're all looking for the **LUXURY LIFE** exciting electric food mixer



**It whips and it beats, it stirs and it mixes, it chops and it grinds, with so little effort, in no time at all.**

It's amazingly versatile and has more attachments than any other standard hand-held mixer on the market. It comes with a 110 page book of recipes to let the housewife know just how many kitchen tasks it will efficiently, speedily perform. And all for the very acceptable retail price of £8.19.6!

Brilliantly presented in eye-catching display pack.

Other Luxury Life Domestic Appliances include



HAIR DRYER



ELECTRIC BLANKET



AUTOMATIC COOKING APPLIANCES



FAN HEATER

# *Bridges*

Luxury Life appliances are made by Bridges, makers of the famous electric Home Workshop drills.

S. N. BRIDGES & CO. LTD., YORK ROAD, BATTERSEA, LONDON S.W.11. Tel : BATtersea 6464



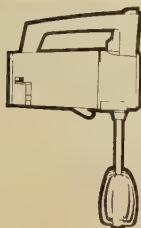




It's a mixer!  
It's a liquidiser!

# Kenwood Chefette

The Kenwood Chefette is unique! One way up it's an electric mixer. Turn it on end and it's a liquidiser ...chopping and blending raw vegetables into smooth, quick-cooking soups...making purees of fruit or vegetables. Turning fresh ingredients into perfect foods in seconds...saving shillings a week on half-used tins! The Chefette is wonderful for preparing all-the-family foods—from sponge cakes to milk shakes. All this for £11.5.0 tax paid (or easy terms)!



THIS WAY The Chefette is the quickest, sturdiest, portable electric mixer—with three speed adjustment—for all mixing Mashes potatoes too!



THAT WAY Stand the Chefette on its 'nose', click in the liquidiser...for mixing drinks, chopping raw vegetables, blending patés, making breadcrumbs, grinding coffee.



PUT AWAY Dual purpose wall bracket is a fixed cradle for using the liquidiser and keeps Chefette safely out of the way when not in use.



Everyone wants a

# Kenwood kitchen!

For full information, and details of generous co-operative advertising terms,

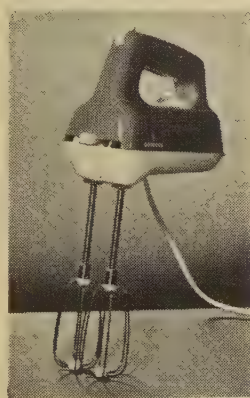
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FOOD MIXERS *[continued]*

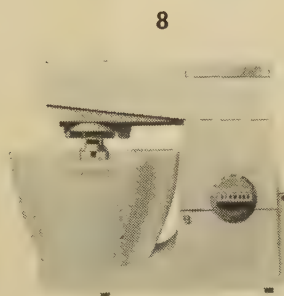
Manufacturer or Distributor	Name or Model	Standard Equipment	Special Features	Finish	Price (excl. P.T.)	Purchase Tax
<b>KENWOOD MANUFACTURING (WOKING), LTD.,</b> Old Woking, Surrey.	"Chef" A.701	"K" beater, whisk, dough hook, glass bowl and polythene spatula	Planetary mixing action, wide variety of attachments. Double insulated	Cream or white, grey plastic relief	£24 9 7	£4 18 5
	A.955 "Kenmix 55"	Liquidiser and power unit	Can be taken apart for easy cleaning	White, red, blue, pink, grey	£13 2 3	£2 12 9
Kenwood "Chef" accessories:—Juice extractor, £1 9s 6d (plus 3s purchase tax); oil dripper, 4s 7d (5d); coffee mill, £4 9s 6d (9s); colander and sieve, £2 8s 2d (4s 10d); continuous juice separator, £5 13s 7d (11s 5d); adaptor, £3 11s 9d (7s 3d); can opener, £2 6s 4d (4s 8d); bean slicer and pea huller, £2 7s 3d (4s 9d); glass bowl, £1 2s 9d (2s 3d); stainless steel bowl, £4 6s 4d (8s 8d); liquidiser, £4 16s 4d (9s 8d); mincer, £3 6s 9d (6s 9d); slicer and shredder, £4 10s 5d (9s 1d); continuous high-speed slicer and shredder, £4 9s 11d (9s 1d); potato peeler, £4 16s 4d (9s 8d); sausage adaptor, 6s 10d (8d).						
<b>LONOR, LTD.,</b> 215-221, Regent Street, London, W.1.	"Siemens" KSM/300 rapid mixette	Twin beaters and kneaders	Three-speed, double insulated, thumb switch	Blue, orange or yellow	£8 15 3	£1 14 9
<b>METWAY ELECTRICAL INDUSTRIES, LTD.,</b> Canning Street, Brighton, 7.	"Mixaway" DA.19116	Two beaters, 2 glass bowls (2 and 6 pt), stand and turntable	All insulated, revolving turntable	Ivory plastic, blue handle and switch	£19 11 6	£3 17 9
Accessories:—Blender, £6 15s 6d (13s 6d purchase tax); juice extractor, £1 19s (3s 10d); meat mincer, £3 8s (6s 9d); grater, £4 15s (9s 5d); potato peeler, £4 10s (8s 11d); coffee grinder, £3 15s 6d (7s 6d); drill set, £1 15s (3s 6d); polishing brush, 15s (1s 6d).						
<b>NOREL ELECTRICAL APPLIANCES, LTD.,</b> 185, Hammersmith Road, London, W.6.	"Norel" hand mixer	Two beaters	Guaranteed 3 years. Dough kneaders and adjustable wall fixture available	Ivory, rose, pastel-blue or white plastic	£10 8 0 £1 0 0 (dough kneader) £1 5 0 (wall fixture)	£2 1 3 £0 4 1  £0 5 3
	"Norel" coffee grinder		Double insulated. Guaranteed 1 year	Red, blue, turquoise, all with white upper part and transparent top	£4 0 0	£0 16 10
<b>PHILIPS ELECTRICAL, LTD.,</b> Century House, Shaftesbury Avenue, London, W.C.2.	Philips Food Mixer H.M.3000	Two stainless steel beaters, plastic spatula	Finger-tip control, flat base for standing	Dove grey and white plastic	£5 17 1	£1 3 7
	Philips "Whiskette" H.M.3020		Finger-tip control	Dove grey and white plastic	£3 6 7	£0 13 5



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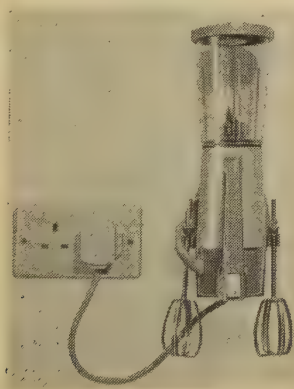


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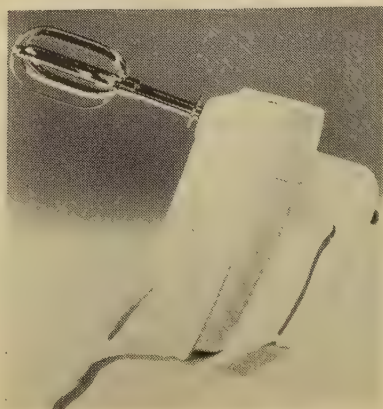


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6. Siemens A.G. model KSM.300 food mixer (Lonor, Ltd.)

7. Hillman "Hillma-mix" liquidiser/grinder

8. Kenwood "Chef" model A.701

9. Metway "Mixaway" food mixer

10. Kenwood "Chefette" model A.320

11. Norel heavy duty hand mixer



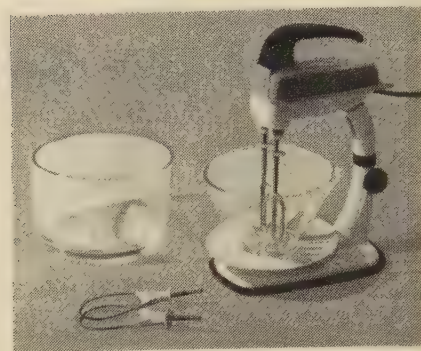
## FOOD MIXERS [continued]

12. A. E. Warner "Turmix 450" mixer
13. Rudson, Wood "Peugeot" model D1 food mixer
14. Whitehall Rotary model JO8 "Combinette" multi-purpose unit
15. Philips food mixer
16. Sunbeam "Junior Mixmaster" food mixer

12



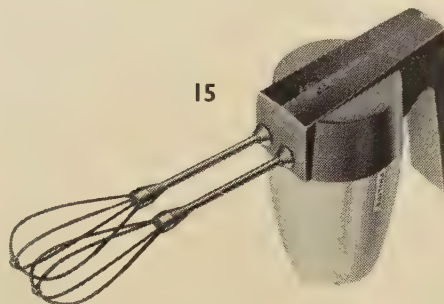
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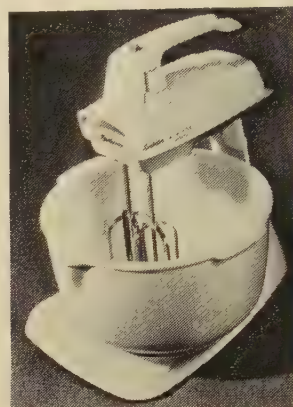
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Manufacturer or Distributor	Name or Model	Standard Equipment	Special Features	Finish	Price (excl. P.T.)	Purchase Tax
<b>RUDSON, WOOD &amp; CO., LTD.,</b> 6, Kilburn High Road, London, N.W.6.	Peugeot "D1"	Two pairs beaters, 2 glass bowls, turntable	2-speed, heavy duty	Green and white	£12 7 4	£2 9 8
	Peugeot "Squirrel"	Two pairs beaters	Lightweight, finger-tip control	White	£4 6 8	£0 17 5
	"Juice King"	Juice extractor	Double insulated, overload safety switch, citrus fruit and shredding attachments available	White and grey plastic, stainless and acid resisting cutters	£11 10 10 £2 2 0 (citrus fruit attach.) £6 5 1 (shredding attach.)	£2 6 4 £0 3 10 £0 12 7
<b>SUNBEAM ELECTRIC, LTD.,</b> Nerston, East Kilbride, Glasgow.	"Junior Mixmaster"	Stand, glass mixing bowl, plastic spatula	Can be used as hand mixer, 3-speed motor	White plastic	£14 13 11	£2 3 1
	Set of five attachments (knife sharpener, buffer, lambswool bonnet for buffer, drink mixer and whipper), £2 15s (plus 5s 6d purchase tax); dough hook, 16s 4d (plus 1s 8d tax).					
	"Mixmaster"	Two bowl-fit beaters, two bowls	Mix-finder dial, automatic speed control, portable use	White, cream or red stoved enamel, black Bakelite mouldings. White, red or cream with golden trim	£19 14 8	£3 19 5
<b>A. E. WARNER (LONDON), LTD.,</b> 56, Brewer Street, London, W.1.	"Mixmaster" accessories:—Blender, £5 3s 4d (plus 10s 5d purchase tax); mincer, £5 3s 4d (10s 5d); juice extractor (standard), 19s 7d (1s 11d); juice extractor (with glass bowls), £1 11s 7d (3s 3d); slicer and shredder, £4 11s 8d (9s 2d); dough hooks, £1 3s 4d (2s 5d).					
	"Turmix 450"	Available as mixer, juice extractor, vegetable shredder or lemon squeezer	Automatic speed adjustment, 3,000, 8,000 or 12,000 r.p.m.	White	£32 10 0 (metal goblets £2 each extra)	£6 13 3
<b>WHITEHALL ROTARY, LTD.,</b> 12, Whitehall, London, S.W.1. (continued on next page)	Accessories:—Lemon squeezer, £3 10s (plus 14s 5d purchase tax); juice extractor, £5 5s (£1 1s 5d); vegetable shredder, £7 5s (£1 9s 7d).					
	"Rotary" coffee mill V16	Transparent lid	Grinds coffee, wheat, nuts, sugar, etc.	White polystyrene	£2 1 10	£0 8 5
	"Rotary" coffee mill F15	Time switch, transparent lid	Fully automatic, other features as V16		£3 7 6	£0 13 11



Manufacturer or Distributor	Name or Model	Standard Equipment	Special Features	Finish	Price (excl. P.T.)	Purchase Tax
<b>WHITEHALL ROTARY, LTD.,</b> 12, Whitehall, London, S.W.1. (continued)	"Rotary" food mixer S18	Three sets of mixing blades, ejector button	Wall bracket	White polystyrene	£3 7 2	£0 13 7
	"Rotary" food mixer T26	Three sets of mixing blades, ejector button	3-speed control, wall bracket		£4 9 0	£0 18 4
	"Rotary" "Combinette" J08	Three sets of mixing blades, coffee, etc., mill attachment	Wall bracket		£5 19 5	£1 4 7
	"Rotary" kitchen set M38	As J08, plus soup and vegetable chopper/mixer	Wall bracket, presentation packing		£6 17 7	£1 7 8

## KETTLES

Manufacturer or Distributor	Name or Model	Capacity	Element Loading	Body	Handle	Special Features	Price (excl. tax)	Purchase Tax
<b>A.E.I. HOTPOINT, LTD.,</b> 33, Grosvenor Place, London, S.W.1.	"Hotpoint" "Hi-Speed" 3QD	3 pint	2.6 kW (230/250 V a.c. only), 2.3 kW, 1.5 kW and 1 kW	Chromium plated copper	Moulded plastic, red or black	Self-resetting automatic safety cut-out	£4 2 11	£0 17 1
<b>BESCOL (ELECTRIC), LTD.,</b> 118, Parkfield Road, Saltley, Birmingham, 8.	"Elephant" 208 (a) and 208R (b)	3 pint	1,500 W (a) and 2,000 W (b)	Chromium plated copper	Black or red Bakelite	Thermostatic safety device	£4 1 5	£0 16 2
	"Elephant" 214 (a) and 214R (b)	3-4 pint	1,500 W (a) and 2,000 W (b)	Polished aluminium	Black or red Bakelite	Thermostatic safety device	£3 0 5	£0 12 0
<b>BEST PRODUCTS, LTD.,</b> Felix Works, Felixstowe, Suffolk. (continued on next page)	"Fanfare"	3½ pint	1,500 W with cut-out	Chromium plated copper	Black or red Bakelite	Organ toned musical alarm	£4 15 0	£0 19 1
	"Jiffy"	2 pint	1,250 W	Chromium plated copper	Black Bakelite	Fast boiling, handle fixing prevents steam damage	£3 7 3	£0 13 6
	"Herald"	4 pint	1,500 W	Anodised aluminium (range of 6 colours)	Black Bakelite	Organ toned musical alarm	£2 18 9	£0 11 9
	"Standard"	3 pint	1,500 W	Polished aluminium	Metal strip, moulded grip	Block spout	£2 17 1	£0 11 5



17

17. Bulpitt Swan Brand electric jug  
18. Bulpitt Swan Brand "Siren" whistling kettle  
19. Bulpitt Swan Brand "Royal" kettle  
20. Bescol model 208 "Elephant" kettle  
21. A.E.I.-Hotpoint "Hi-Speed" kettle  
22. Best Products "Essex" kettle



18



19



20



21



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## KETTLES [continued]

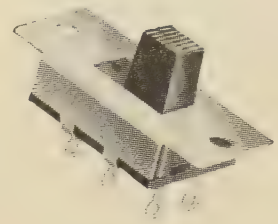
Manufacturer or Distributor	Name or Model	Capacity	Element Loading	Body	Handle	Special Features	Price (excl. tax)	Purchase Tax
<b>BEST PRODUCTS, LTD.,</b> Felix Works, Felixstowe, Suffolk. (continued)	"Suffolk"	3½ pint (a) 3 pint (b)	1,500 W (a) 2,000 W (b)	Chromium plated copper	Black or red Bakelite	Fast boiling, block spout	£3 19 6 (a) £4 0 10 (b)	£0 15 11 (a) £0 16 3 (b)
	"Essex"	3½ pint (a) 3 pint (b)	1,500 W (a) 2,000 W (b)	Polished aluminium	Black or red Bakelite	Fast boiling, block spout	£3 1 4 (a) £3 2 7 (b)	£0 12 3 (a) £0 12 6 (b)
<b>BULPITT &amp; SONS, LTD.,</b> St. George's Works, 132, Icknield Street, Birmingham. (continued on page 12)	"Royal" CH.102	2 pint	1,000 W	Chromium plated copper	Fittings (handles, knobs, etc.) available in cherry red or black plastic. Both supplied at the same price.	Safety positioned knob and steam vent	£3 9 9	£0 14 0
	"Royal" CH.103A	3 pint	1,500 W	Chromium plated copper		Safety positioned knob and steam vent	£4 2 5	£0 16 7
	"Royal" CH.103C and CH.103E	3 pint	2,300 W and 2,750 W	Chromium plated copper		Safety positioned knob and steam vent	£4 2 5	£0 16 7
	"Royal" CH.104F	4 pint	3,000 W	Chromium plated copper		Safety positioned knob and steam vent	£4 15 1	£0 19 2
	"Royal" CH.105	5 pint	2,000 W	Chromium plated copper		Safety positioned knob and steam vent	£4 15 1	£0 19 2
	"Regal" A.383E	3 pint	2,750 W	Polished aluminium		Safety positioned knob and steam vent	£3 7 2	£0 13 7
	"Siren" CH.440 and CH.440D	3 pint	2,000 W and 2,500 W	Chromium plated copper		Trigger action lid with built-in whistle	£4 12 7	£0 18 8
	"Swift" CH.303 and CH.303D	3 pint	2,000 W and 2,500 W	Chromium plated copper		Fast boiling	£4 4 1	£0 16 11
	"Popular" C.223	3 pint	1,000 W	Polished copper		Safety positioned knob and steam vent	£3 15 8	£0 15 4
	"Popular" C.223A	3 pint	1,500 W	Polished copper		Safety positioned knob and steam vent	£3 15 8	£0 15 4
	"Popular" C.226	6 pint	2,000 W	Polished copper		Safety positioned knob and steam vent	£4 15 1	£0 19 2
	"Popular" CH.223	3 pint	1,000 W	Chromium plated copper		Safety positioned knob and steam vent	£3 15 8	£0 15 4
	"Popular" CH.223A	3 pint	1,500 W	Chromium plated copper		Safety positioned knob and steam vent	£3 15 8	£0 15 4
	"Popular" CH.224A	4 pint	1,500 W	Chromium plated copper		Safety positioned knob and steam vent	£4 6 8	£0 17 4
	"Popular" CH.224B	4 pint	2,000 W	Chromium plated copper		Safety positioned knob and steam vent	£4 6 8	£0 17 4
	"Popular" CH.226	6 pint	2,000 W	Chromium plated copper		Safety positioned knob and steam vent	£4 15 1	£0 19 2
	"Popular" A.223	3 pint	1,000 W	Aluminium		Safety positioned knob and steam vent	£2 18 9	£0 11 9
	"Popular" A.223A	3 pint	1,500 W	Aluminium		Safety positioned knob and steam vent	£2 18 9	£0 11 9
	"Popular" A.224A	4 pint	1,500 W	Aluminium		Safety positioned knob and steam vent	£3 5 6	£0 13 3
	"Popular" A.224B	4 pint	2,000 W	Aluminium		Safety positioned knob and steam vent	£3 5 6	£0 13 3



# Arcoelectric

## Switches

## Neon Signal Lamps



T.225

**T.225:** Miniature Slide Switch  
For Portable Radios, D.P.D.T.

**S.L.190 and S.L.50:**  
Snap-in Fixing Neon Indicators.

**S.L.162:** Waterproof Neon Indicator.

**A.56:** Door Switch for Refrigerators.  
Snap-in fixing.

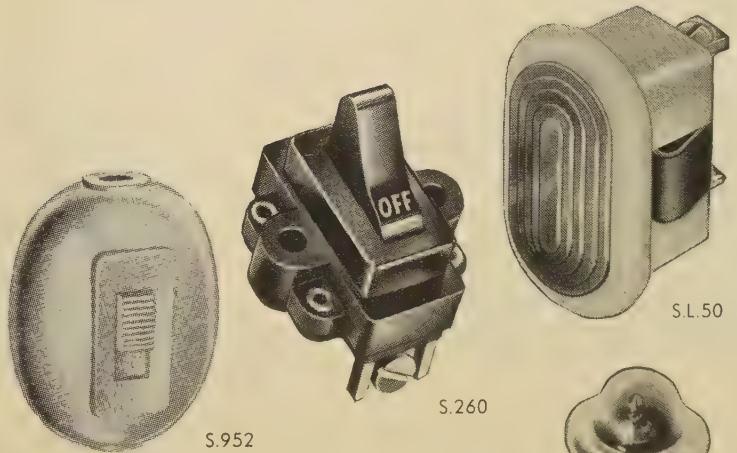
**G.605:** Toggle Switch,  
New style spade dolly.

**S.260:** All insulated 15-amp. Switch.

**C.S.200:** 15-amp. 4 Position Rotary Switch,  
Double pole 3-heat control for cookers.

**S.952:** Miniature Line Cord Switch.

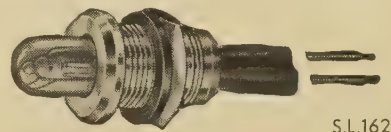
**S.960:** Spin Dryer Switch.



S.952

S.260

S.L.50



S.L.162

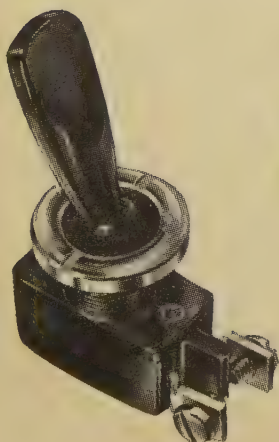


S.L.190

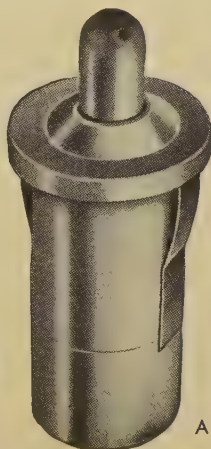
*Write for latest Catalogue*

## Arcoelectric Switches Ltd.

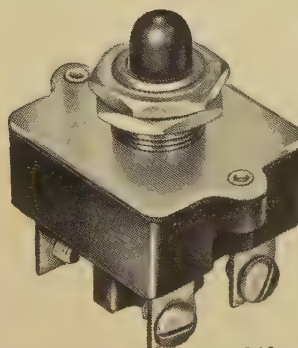
Central Avenue - West Molesey - Surrey - Tel: Molesey 3232



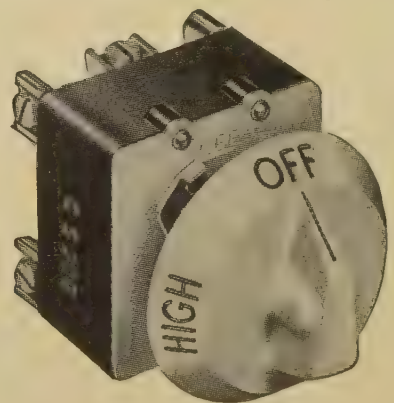
G.605



A.56



S.960



C.S.200



## KETTLES [continued]

Manufacturer or Distributor	Name or Model	Capacity	Element Loading	Body	Handle	Special Features	Price (excl. tax)	Purchase Tax
<b>BULPITT &amp; SONS, LTD.,</b> St. George's Works, 132, Icknield Street, Birmingham. (continued)	" Popular " A.226	6 pint	2,000 W	Aluminium	Fittings (handles, knobs, etc.) available in cherry red or black plastic. Both supplied at the same price.	Safety positioned knob and steam vent	£3 11 10	£0 14 5
	Combined kettle and saucepan CH.353	Kettle: 3 pint. Inner pan: 1½ pint	2-heat 1,250/125 W	Chromium plated copper. Aluminium pan		—	£4 17 2	£0 19 7
	Electric jug A.521	1 pint	600 W	Aluminium		Pilot light, thermostatic	£4 13 0	£0 18 6
<b>CO-OPERATIVE WHOLESALE SOCIETY, LTD.,</b> National Works, Hall Street, Dudley, Worcs.	" C.W.S. Dudley "	3 pint	1,250 W	Polished aluminium	Black Bakelite	—	£2 12 0	£0 10 6
	" C.W.S. Dudley "	3 pint	1,500 W	Polished aluminium	Black Bakelite	—	£2 14 0	£0 11 0
	" C.W.S. Dudley "	3 pint	1,250 W	Vitreous enamel	Vitreous enamel	—	£2 14 0	£0 11 0
<b>A. D. DAVIDSON INDUSTRIES, LTD.,</b> Granville Street, Birmingham, I.	" Paramount "	3 pint	1,500 W (a) 2,000 W (b)	Chromium plated copper	Black Bakelite	Spout filling, no lid	£3 10 0 (a) £3 12 0 (b)	£0 14 2 (a) £0 14 6 (b)
<b>DEPENDABLE PRODUCTS, LTD.,</b> Queensway, Team Valley Trading Estate, Gateshead, II.	" Regal "	3½ pint	1,500 W	Aluminium (a) Chromium (b)	Moulded plastic	—	£3 1 2 (a) £3 11 7 (b)	£0 12 4 (a) £0 14 5 (b)
	" Royal "	3½ pint	1,500 W	Aluminium (a) Chromium (b)	Moulded plastic	—	£3 1 2 (a) £3 11 7 (b)	£0 12 4 (a) £0 14 5 (b)
<b>ELTRON (LONDON), LTD.,</b> Strathmore Road, Croydon, Surrey.	" De Luxe "	1½ pint	500, 700 and 1,000 W	Polished aluminium	Red Bakelite	Removable element	£2 17 0 (500 W) £3 0 6 (700 W) £3 11 6 (1,000 W)	£0 11 8 (500 W) £0 12 5 (700 W) £0 14 9 (1,000 W)
	Car Kettle	1½ pint (a) 1¾ pint (b)	—	Polished aluminium	Black Bakelite	For use on 12 V car battery	£1 15 0 (a) £2 12 6 (b)	£0 1 0 (a) £0 2 9 (b)
<b>G.E.C. (DOMESTIC EQUIPMENT), LTD.,</b> Langley House, Hanger Lane, Ealing, W.5.	D.5193	3 pint	2,000 W	Polished aluminium	Black or red Bakelite	Super-speed boiling, re-set safety device	£3 5 6	£0 13 2
	D.5195	5 pint	2,000 W	Polished aluminium	Black Bakelite	Super-speed boiling, re-set safety device	£3 13 7	£0 14 9
	D.5235	5 pint	2,000 W	Chromium plated copper	Black Bakelite	Super-speed boiling, re-set safety device	£5 9 11	£1 2 1
	D.5353A	3 pint	2,000 W	Chromium plated copper	Black or red Bakelite	Super-speed boiling, re-set safety device	£4 4 6	£0 17 0
<b>L. G. HAWKINS &amp; CO., LTD.,</b> 30-35, Drury Lane, London, W.C.2.	L.G.H.707	3½ pint	1,500 W	Polished aluminium	Steel with plastic grip	Automatic	£2 19 6	£0 12 0
	L.G.H.66	3½ pint	1,500 W	Chromium plated copper	Steel with plastic grip	Automatic	£4 12 6	£0 18 7
	L.G.H.203	2 pint	750 W	Polished aluminium	Metal	Non-automatic	£1 17 4	£0 7 6
	L.G.H.303	2 pint	750 W	Polished aluminium	Metal	Automatic	£2 1 8	£0 8 5
	L.G.H.603	3 pint	1,000 W	Polished aluminium	Polished aluminium	Non-automatic	£2 1 3	£0 8 4
	L.G.H.703	3 pint	1,000 W	Polished aluminium	Polished aluminium	Automatic	£2 6 6	£0 9 4
	" Jersey Jug " L.G.H.606	3 pint	1,000 W	Chromium plated copper	Plastic	—	£4 0 4	£0 16 2

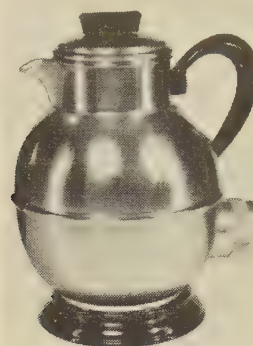




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23. L. G. Hawkins model L.G.H.707 kettle  
 24. Lincass model 950/951 kettle  
 25. L. G. Hawkins "Jersey" electric jug  
 26. Eltron de-luxe 12 V car kettle  
 27. G.E.C. model 5353A kettle  
 28. C.W.S. "Dudley" kettle  
 29. A. D. Davidson "Paramount" kettle



27



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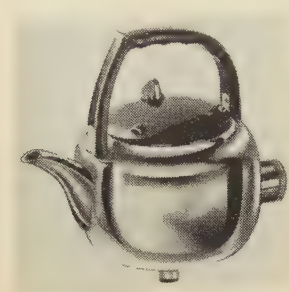


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Manufacturer or Distributor	Name or Model	Capacity	Element Loading	Body	Handle	Special Features	Price (excl. tax)	Purchase Tax
LINCASS ELECTRIC, LTD., Guildford Street, Chertsey, Surrey.	950/951	3½ pint	1,000 and 1,500 W	Chromium plated copper	Metal, plastic grip	—	£3 17 6 (1 kW) £3 19 6 (1½ kW)	£0 15 6 (1 kW) £0 16 0 (1½ kW)
	780/781	3½ pint	1,000 and 1,500 W	Aluminium, coloured enamel finish	Metal, plastic grip	—	£3 2 6 (1 kW) £3 4 6 (1½ kW)	£0 12 6 (1 kW) £0 12 9 (1½ kW)
	770/771	3½ pint	1,000 and 1,500 W	Polished aluminium	Metal, plastic grip	—	£2 15 6 (1 kW) £2 17 6 (1½ kW)	£0 11 1 (1 kW) £0 11 8 (1½ kW)
LONDON ALUMINIUM CO., LTD., Charles Henry Street, Birmingham, 12.	E.560 Popular	4 pint	1,500 W	Aluminium	Plastic, red or black	Streamlined body	£2 10 4	£0 10 2
	E.564 Streamline	4 pint	1,500 W	Aluminium	Plastic, red or black		£3 2 9	£0 12 8
	E.564RL and E.564BL	4 pint	1,500 W	Aluminium, red or blue lacquered	Plastic, black		£3 3 0	£0 12 8
	E.1100	4 pint	1,500 W	Chromium plated copper	Plastic, black		£3 11 10	£0 14 6
METWAY ELECTRICAL INDUSTRIES, LTD., Canning Street, Kemp Town, Brighton, 7. (continued on next page)	"Midgetway" D.A.303	2 pint	750 W	Polished aluminium	Black moulded plastic	Non-automatic	£1 17 6	£0 7 5
	"Miniway" DA.423	2 pint	750 W	Polished aluminium	Moulded plastic	Non-automatic	£2 2 3	£0 8 5
	"Miniway Rex" DA.470	2 pint	750 W	Polished aluminium	Moulded plastic	Automatic	£2 7 0	£0 9 4
	"Fastaway" DA.638	4 pint	1,000 W	Polished aluminium	Red moulded plastic	Automatic	£3 3 8	£0 12 8
	"Fastaway" DA.640	4 pint	1,250 W	Polished aluminium	Red moulded plastic	Automatic	£3 4 0	£0 12 9

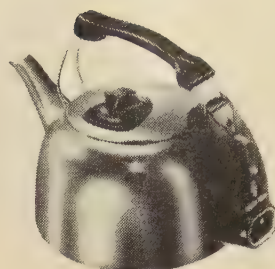


## KETTLES [continued]



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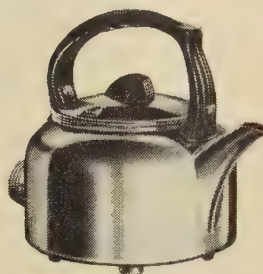
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30. Metway "Fastaway De-Luxe" kettle  
 31. Russell Hobbs model K.2 vapour-controlled kettle  
 32. Metway "Nestaway" 12 V car kettle  
 33. Pifco model 1074 kettle  
 34. Mirroware "Mirro-Matic" model EL.981 kettle  
 35. Revo "Savoy" kettle

Manufacturer or Distributor	Name or Model	Capacity	Element Loading	Body	Handle	Special Features	Price (excl. tax)	Purchase Tax
<b>METWAY ELECTRICAL INDUSTRIES, LTD.,</b> Canning Street, Kemp Town, Brighton, 7. (continued)	"Fastaway" DA.654	4 pint	1,500 W	Polished aluminium	Red moulded plastic	Automatic	£3 5 4	£0 12 11
	"Fastaway" DA.673	4 pint	1,800 W	Polished aluminium	Red moulded plastic	Automatic	£3 7 3	£0 13 3
	"Fastaway De-Luxe" DA.698	4 pint	2,000 W	Polished aluminium, red lid	Red moulded plastic	Automatic	£3 9 8	£0 13 10
	"Nestaway" car kettle DA.12360	2 pint	200 W	Polished aluminium	Black moulded plastic	12 V only	£1 16 0	£0 7 2
<b>THE MIDLAND METAL SPINNING CO., LTD.,</b> Tower Works, Pelham Street, Wolverhampton.	"Tower Brand" 034 (a) and 082 (b)	4 pint	1,500 W	Polished aluminium (a) Chromium plated copper (b)	Bakelite	—	£2 15 0 (a) £3 12 6 (b)	£0 11 0 (a) £0 14 5 (b)
	"Mirro-Matic" EL.981 and EL.982	4 pint	1,500 W or 2,000 W	Chromium (EL.981) Polished aluminium (EL.982)	Black Bakelite	Red, blue, misty blue lids, spherical shape	£4 7 0 (EL.981) £3 8 3 (EL.982)	£0 17 6 (EL.981) £0 13 9 (EL.982)
<b>MIRROWARE CO., LTD.,</b> Edgware Road, London, W.2.	"Mirro-Matic" EL.582	4 pint	1,500 W	Aluminium	Red Bakelite	—	£2 17 11	£0 11 7
	"Mirro-Matic" EL.975	2 pint	1,000 W	Chromium	Black Bakelite	Streamline handle, spherical shape	£3 10 9	£0 14 3
<b>PIFCO, LTD.,</b> Watling Street, Manchester, 4.	1074	4 pint	1,500 W	Golden anodised body, black lid	Black plastic handle grip	Non-drip spout, plastic feet, cut-out	£3 11 11	£0 14 5
	1081	3½ pint	2,000 W	Chromium plated copper	Black plastic handle grip	Plastic feet, cut-out	£4 2 5	£0 16 7
	1084	3½ pint	2,000 W	Polished aluminium, red anodised lid	Red plastic handle grip	Non-drip spout, plastic feet, cut-out	£3 4 2	£0 12 11



if  
it's  
designed  
to

**move**

*specify a  
cable that can move  
with it . . .*

Time's gone when an electric stove or refrigerator was static, to be moved only by the man of the house each spring. Today's leading models are made to move at the touch and will if . . . AND IT IS AN IF . . . the cable moves with it. Nobody will enthuse over those castors if it means straightening out a kinky lead. Permanoid Super Flexible is made from a plastic formulated to withstand maximum movement, its freedom can be compared to rubber, it remains flexible down to 20° C., takes tension, possesses high insulating properties and has a finish to grace any appliance. If you make an appliance which moves in operation or which can be moved, specify

# PERMANOID

## SUPER FLEXIBLE

(Details/Samples on request)

Permanoid Limited

Mfrs. of Flexibles, Sleeveings & Connecting Wires

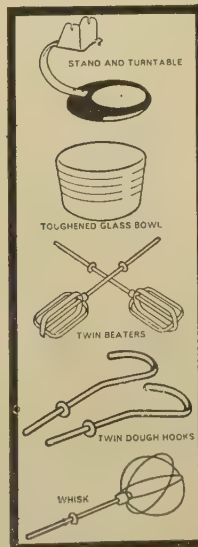
Manchester 4 COL 1371

# ANOTHER BYLOCK WINNER!



### ON THE STAND—OR IN THE HAND

A 3 speed, dual purpose Food Mixer—  
complete with stand, bowl,  
twin dough hooks, twin beaters, whisk  
and turntable to ensure a *complete mix*—  
for only **£10.17.8**—  
**ONE Year's guarantee!**



- Light—neatly packs away. Powerful enough to tackle really tough mixes.
- Dual purpose—either fixed or portable.
- No messy handling. Accessories released by push button ejector.
- Bowl rotation ensures complete mix.
- The Bylock does all the hard work, and the results—perfect every time.

*At last—a food mixer every housewife can afford!*

### SPECIFICATIONS

Motor	Universal 230/250 v 75 watts
Whisk	Chromium plated
Dough Hooks & Beaters	Toughened Glass
Bowl	Ball bearing mounted
Turntable	12 MONTHS' GUARANTEE

Contact Bylock for full details.

BYLOCK ELECTRIC LTD • ENFIELD • MIDDX • TEL: HOWARD 2481



KETTLES *[continued]*

Manufacturer or Distributor	Name or Model	Capacity	Element Loading	Body	Handle	Special Features	Price (excl. tax)	Purchase Tax
REVO ELECTRIC CO., LTD., Tipton, Staffs.	" Savoy "	3 pint	2,000 W	Chromium plated copper	Black Bakelite	Quick heating element, cut-out	£3 19 6	£0 16 0
RUSSELL HOBBS, LTD., 1, Bensham Lane, West Croydon, Surrey.	" Russell Hobbs " K.2	3½ pint	1,750 W	Chromium plated copper	Moulded plastic	Vapour controlled, switches off when water boils	£4 9 0	£0 17 7
	" Russell Hobbs " KZR	3½ pint	2,400 W	Chromium plated copper	Moulded plastic	Vapour controlled, switches off when water boils	£4 12 6	£0 18 4

## PERCOLATORS

Manufacturer or Distributor	Name or Model	Capacity	Element Loading	Body	Handle	Special Features	Price (excl. tax)	Purchase Tax
BEST PRODUCTS, LTD., Felix Works, Felixstowe, Suffolk.	" Best " No. 4	1½ to 2½ pint	500 W	Chromium on copper or pastel enamel shades	Black Bakelite	Automatic cut-out, indicator lights, pre-set percolation	£6 17 5 (chromium) £6 7 3 (enamel)	£1 7 7 (chromium) £1 5 6 (enamel)
	" Warwick "	1½ to 2 pint	500 W	Ceramic, pastel shades	As body and lid	Black lid and matching base	£3 15 11	£0 15 3
BULPITT & SONS, LTD., St. George's Works, Icknield Street, Birmingham, 18. <i>(continued on next page)</i>	" Mayfair " 480 S	1½ pint	400 W	Chromium plated copper	Black moulded plastic	Re-set safety device	£5 7 9	£1 1 9

**kettle**

**elements**

**Rubicon**

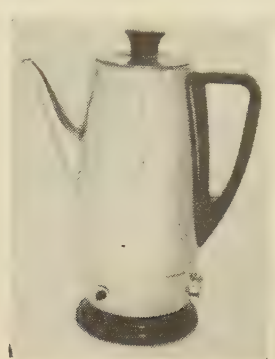
designed and manufactured by  
**CONTROLLED HEATING UNITS (LONDON) LTD.,**  
 AVENUE ROAD · HAMPTON · MIDDX.  
 MOlesey - 3285-7





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36. S.L.R. "Phoenix" coffee percolator
37. Lincass model 651 coffee percolator
38. Falk, Stadelmann "Sona" coffee percolator
39. G.E.C. model D.5373 coffee percolator
40. Best Products enamelled type coffee percolator
41. Bulpitt "Winchester" coffee percolator
42. Russell Hobbs ceramic coffee percolator



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Manufacturer or Distributor	Name or Model	Capacity	Element Loading	Body	Handle	Special Features	Price (excl. tax)	Purchase Tax
<b>BULPITT &amp; SONS, LTD.,</b> St. George's Works, Icknield Street, Birmingham, 18. (continued)	"Dorchester" 450 S	2 pint	400 W	Polished aluminium	Black moulded plastic	Re-set safety device	£3 15 8	£0 15 1
	"Winchester" 490	2 pint	450 W	Aluminium, chromium plated	Black moulded plastic	Fully automatic	£5 7 9	£1 1 9
<b>"CONA" COFFEE MACHINE CO.,</b> Felden Works, Railway Place, Wimbledon, S.W.19.	"New" Table Model, A, B, C & D	$\frac{1}{2}$ to 2 pint	350 W	Chromium plated zinc stand, glass bowls	Metal and plastic	Accessories include funnels and drainers	£6 2 3 to £7 3 3	£1 3 7 to £1 7 7
	"Rex"	1 $\frac{1}{2}$ pint	350 W	Cast aluminium stand, glass bowls	Incorporated in body	On-off switch. Obtainable in range of enamelled colours	£8 19 9	£1 14 8
<b>A. D. DAVIDSON INDUSTRIES, LTD.,</b> 62-66, Granville Street, Birmingham, 1.	"Davey" C.601	1 $\frac{1}{2}$ pint	400 W	Chromium on copper	Bakelite	Urn type fitted with tap	£4 19 6	£1 0 0
	"Davey" C.603	2 $\frac{1}{2}$ pint	500 W	Chromium on copper	Bakelite	Urn type fitted with tap	£6 2 6	£1 4 8
	"Davey" C.606	4 $\frac{1}{2}$ pint	950 W	Chromium on copper	Bakelite	Urn type fitted with tap	£8 17 6	£1 15 8
	"Davey" C.618	1 $\frac{1}{2}$ pint	400 W	Chromium on copper	Bakelite	Jug type	£5 8 6	£1 1 10
<b>FALK, STADELMANN &amp; CO., LTD.,</b> 91, Farringdon Road, London, E.C.1.	"Sona"	2 $\frac{3}{4}$ pint	600 W	Chromium plated aluminium	Black Bakelite	Thermostatic controlled, pilot light indicates when coffee is ready	£5 0 1	£1 0 4
<b>G.E.C. (DOMESTIC EQUIPMENT), LTD.,</b> Langley House, Hanger Lane, Ealing, W.5.	D.5373	1 $\frac{1}{2}$ pint	400 W	Chromium on copper	Black Bakelite	High and low heat control, thermal protection device	£6 16 6	£1 7 6

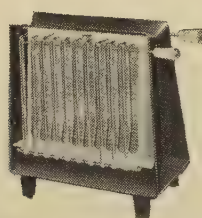


PERCOLATORS *[continued]*

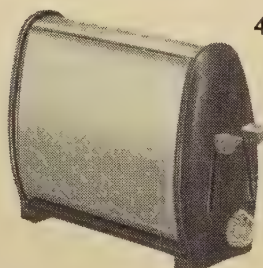
Manufacturer or Distributor	Name or Model	Capacity	Element Loading	Body	Handle	Special Features	Price (excl. tax)	Purchase Tax
LINCASS ELECTRIC, LTD., Guildford Street, Chertsey, Surrey.	651	1½ pint	500 W	Chromium plated, black anodised	Black Bakelite	Earthed connector	£4 4 0	£0 17 0
	681	1½ pint	500 W	Coloured enamel	Black Bakelite	Earthed connector	£4 10 0	£0 18 2
RUSSELL HOBBS, LTD., 1, Bensham Lane, West Croydon, Surrey.	"Russell Hobbs"	1 to 2 pint	600 W	Ceramic, primrose, dove grey and green, three contemporary flower decorations. Also maroon, and "Empire" finish	Ceramic	Time control selector.	£4 9 0	£0 17 7
						Companion sugar basin and jug extra.	£4 12 6	£0 18 4
						(companion set)	£0 15 0	£0 1 6
						Matching coffee set, 6 cups and saucers	£1 12 6 (coffee set)	£0 3 3 (coffee set)
S.L.R. ELECTRIC, LTD., Welbeck Works, Welbeck Road, South Harrow, Middlesex.	"Phoenix" CB.6	1½ pint	500 W	Heat-resisting glass	White Bakelite	Can be used independently on electric hot-plates	£3 0 0	£0 12 4

## TOASTERS

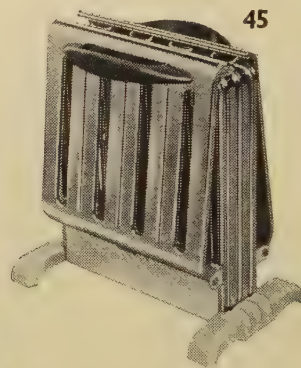
Manufacturer	Name or Model	Type	Number of Slices	Loading	Special Features	Finish	Price (excl. tax)	Purchase Tax
BULPITT & SONS, LTD., Icknield Street, Birmingham, 18.	950	Non-Automatic	Two	500 W	Crumb tray fixed to base	Stove enamelled light bronze, black base. Chromium top	£1 15 6	£0 7 3
	951	Non-Automatic	Two	500 W	Crumb tray fixed to base	Chromium, black base and sides	£1 18 0	£0 7 9



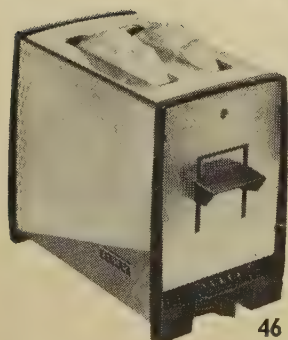
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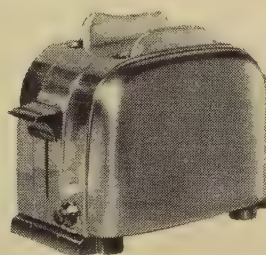
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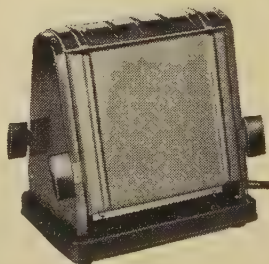
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43. G.E.C. model D.5630 toaster

44. Metway "Toastaway" toaster

45. Lincass model 304 toaster

46. H.M.V. automatic toaster

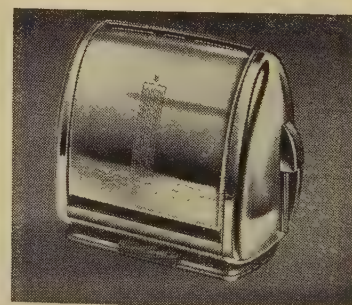
47. Morphy-Richards model TU/ID automatic toaster

48. Bulpitt model 950 toaster

49. Morphy-Richards model TOS automatic toaster

50. L. G. Hawkins model L.G.H.1421 toaster

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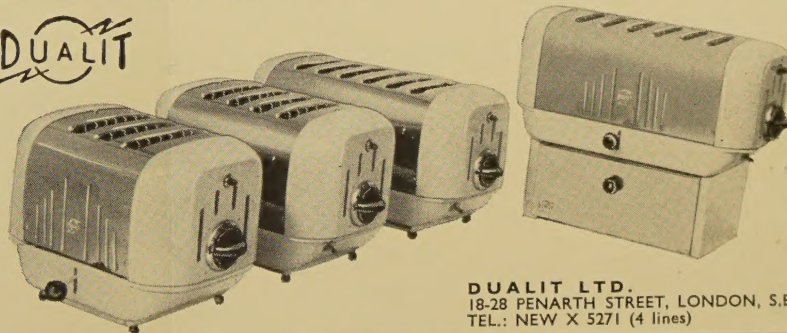
Manufacturer	Name or Model	Type	Number of Slices	Loading	Special Features	Finish	Price (excl. tax)	Purchase Tax
<b>DUALIT, LTD.,</b> 18-28, Penarth Street, London, S.E.15.	147	Non-Automatic	Two	500 W	Automatic turning of slices	Chromium plated	£2 5 0	£0 11 6
	"Semi 3"	Semi-Automatic	Three	1,500 W	Push-button toast ejection	Chromium plated	£7 7 0	—
	"Semi 4"	Semi-Automatic	Four or two	2,000 W	Push-button toast ejection	Chromium plated	£10 10 0	—
	"Semi 6"	Semi-Automatic	Six or three	3,000 W	Push-button toast ejection	Chromium plated	£14 14 0	—
	"Auto 3"	Fully Automatic	Three	1,500 W	Electric time switch and neon indicator lamp	Chromium plated	£10 10 0	—
	"Auto 4"	Fully Automatic	Four or two	2,000 W	Electric time switch and neon indicator lamp	Chromium plated	£14 14 0	—
	"Auto 6"	Fully Automatic	Six or three	3,000 W	Electric time switch and neon indicator lamp	Chromium plated	£19 19 0	—
<b>G.E.C. (DOMESTIC EQUIPMENT), LTD.,</b> Langley House, Hanger Lane, Ealing, W.5.	D.5630	Non-Automatic	Two	600 W	Automatic turning of slices, easy to clean	Chromium plated and black lustre	£2 6 0	£0 9 4
<b>H.M.V. DOMESTIC APPLIANCES, LTD.,</b> 363, Oxford Street, London, W.1.	"H.M.V." HT.160	Automatic	Two	1,000 W	Automatic selector switch	Chromium plated	£5 1 0	£1 0 4
<b>L. G. HAWKINS &amp; CO., LTD.,</b> 30-35, Drury Lane, London, W.C.2.	L.G.H.1421	Non-Automatic	Two	525 W	Single-action handle opens both doors simultaneously	Chromium plated	£3 7 2	£0 13 7
<b>LINCASS ELECTRIC, LTD.,</b> White Hart Yard, Guildford Street, Chertsey.	304	Non-Automatic	Two	500 W	—	Chromium plated	£1 8 6	£0 5 8
<b>METWAY ELECTRICAL INDUSTRIES, LTD.,</b> Canning Street, Brighton, 7.	"Toastaway" DA.3199	Automatic	Four	700 W	Clockwork timer, single movement turnover action	Stainless steel, black moulded ends and base	£3 19 9	£0 15 10
<b>MORPHY-RICHARDS (CRAY), LTD.,</b> 50, Conduit Street, London, W.1.	TU/ID	Automatic	Two	1,250 W	Trip-button for release of toast, 6-position browning control, crumb tray, a.c./d.c.	Chromium (a) or primrose, blue, red or green (b)	£5 17 3 (a) £5 10 1 (b)	£1 3 5 (a) £1 1 11 (b)
	TOS	Automatic	Two	1,100 W	5-position browning control, handle serves as timing cycle switch, crumb tray	Chromium	£4 13 2	£0 18 6
<b>T. PRICE &amp; SON (STAMPERS), LTD.,</b> Spring Hill Passage, Birmingham, 18.	"Prilect" 2054	Non-Automatic	Two	500 W	Automatic turning of slices	Chromium plated	£1 3 4	£0 4 9

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- ★ Switches off when toast is done.
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- ★ You can set Toaster for different grades of toast.
- ★ A crumb tray is incorporated for easy cleaning.
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6 slice Toaster	£19 19s. 0d.	£14 14s. 0d.

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# REGIONAL GUIDE TO ELECTRICAL WHOLESALERS

Following persistent requests we are proposing to include in the ELECTRICAL REVIEW every fourth week a Regional Guide to Electrical Wholesalers, the first to appear on the 5th January, 1962.

In general the Guide will follow the same lines as our Regional Guide to Electrical Contractors, appearing every four weeks in a standard form.

An important difference, however, is that while the Guide for Contractors is confined to half-inch entries, those for the new Guide can be expanded to any multiple of a half-inch in order to accommodate additional information regarding products handled, agencies, etc.

Entries can be made under any of the fifteen areas given below at a charge of £1 18s. 6d. per half-inch insertion and pro rata (minimum number of insertions under any one heading — six: one every four weeks) or £1 15s. per half-inch insertion and pro rata for till countermanded orders (minimum thirteen insertions under one heading).

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**WILL ANY WHOLESALERS WISHING TO AVAIL THEMSELVES OF THIS NEW SERVICE PLEASE INDICATE REQUIREMENTS ON THE COUPON AND RETURN IT TO US AS SOON AS POSSIBLE, TOGETHER WITH APPROPRIATE COPY**

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## REGIONAL GUIDE TO ELECTRICAL WHOLESALERS

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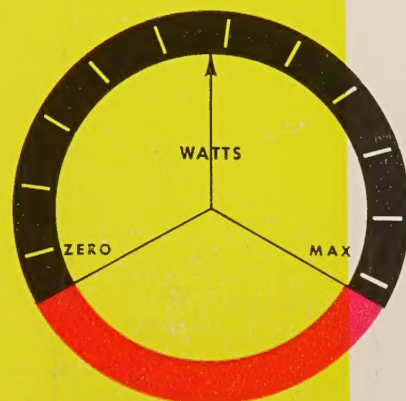
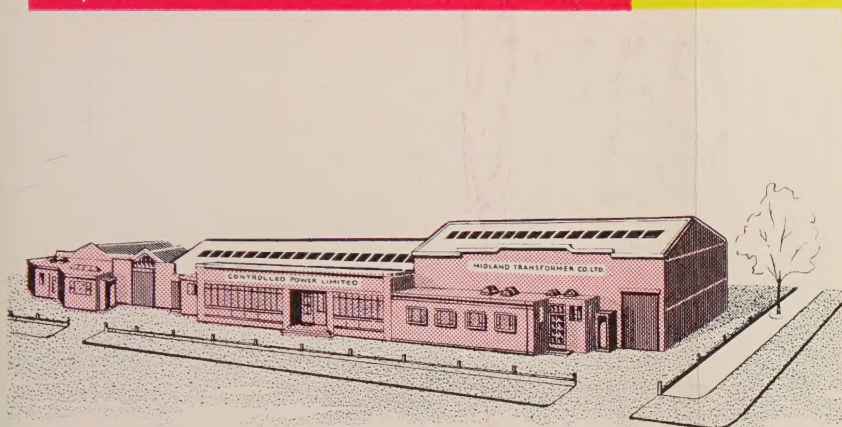
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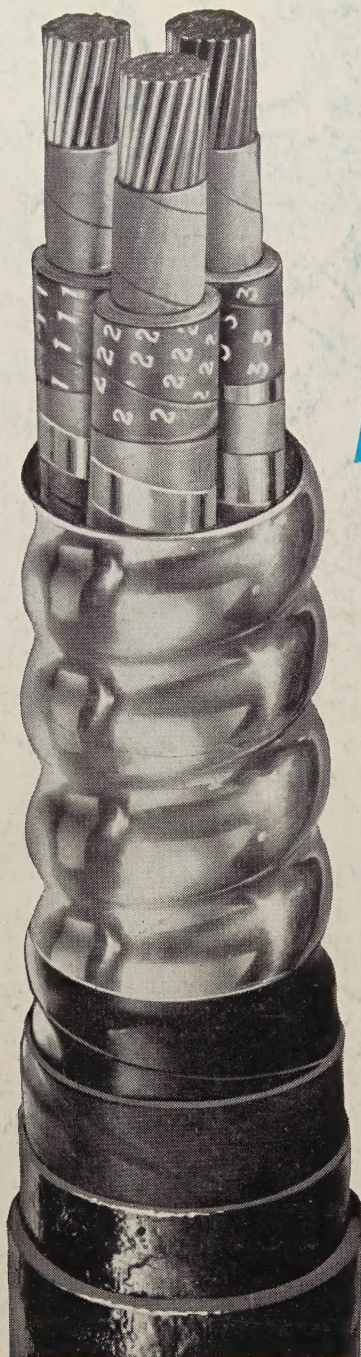
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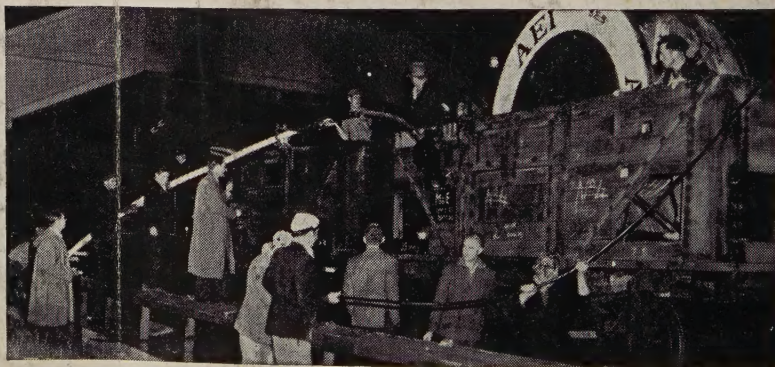
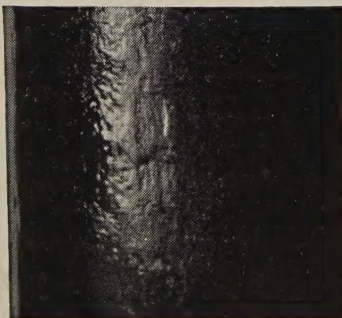




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